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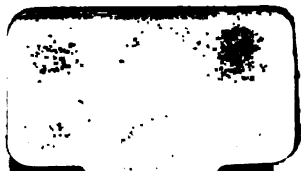


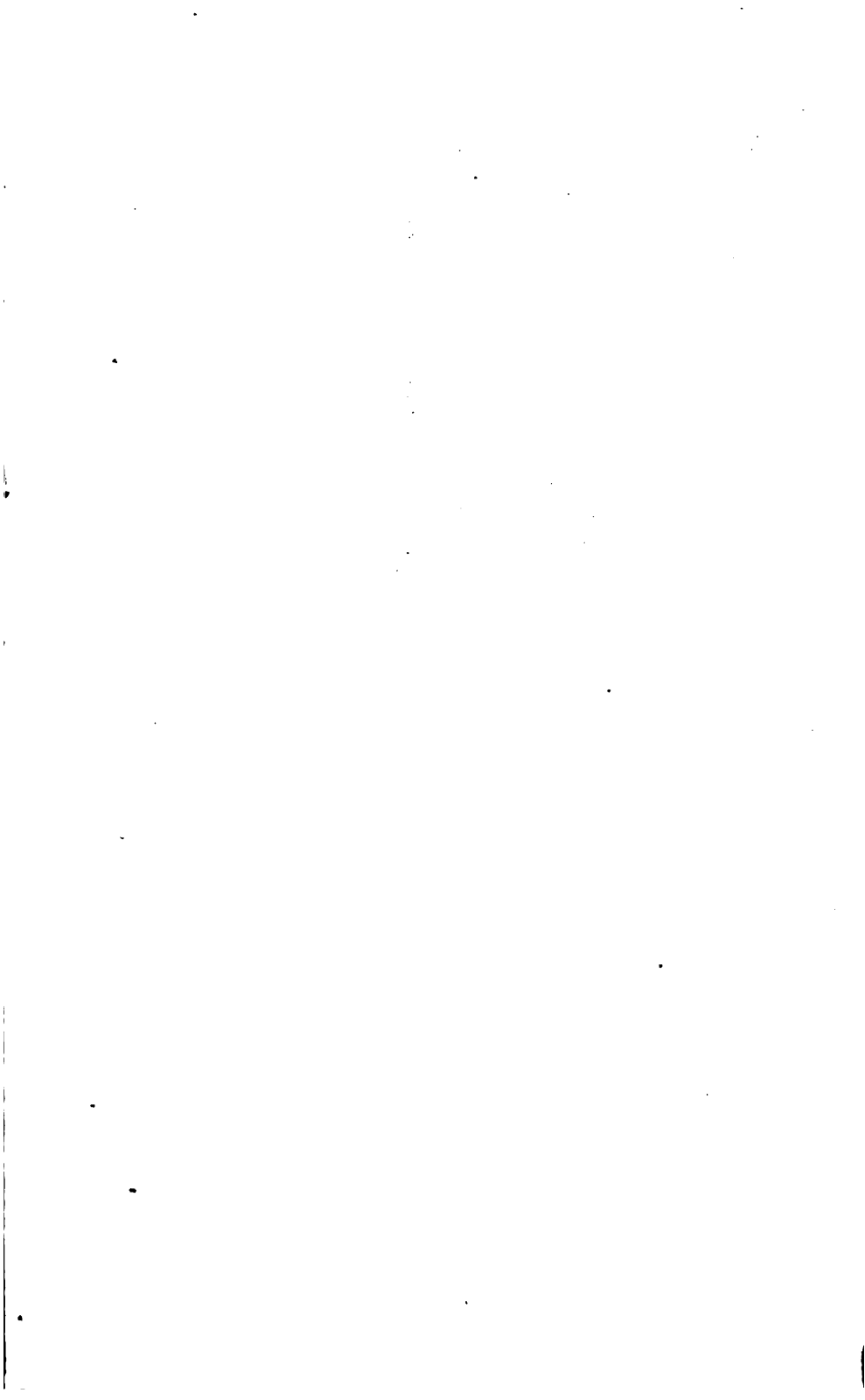
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and the Exhibition of various ob

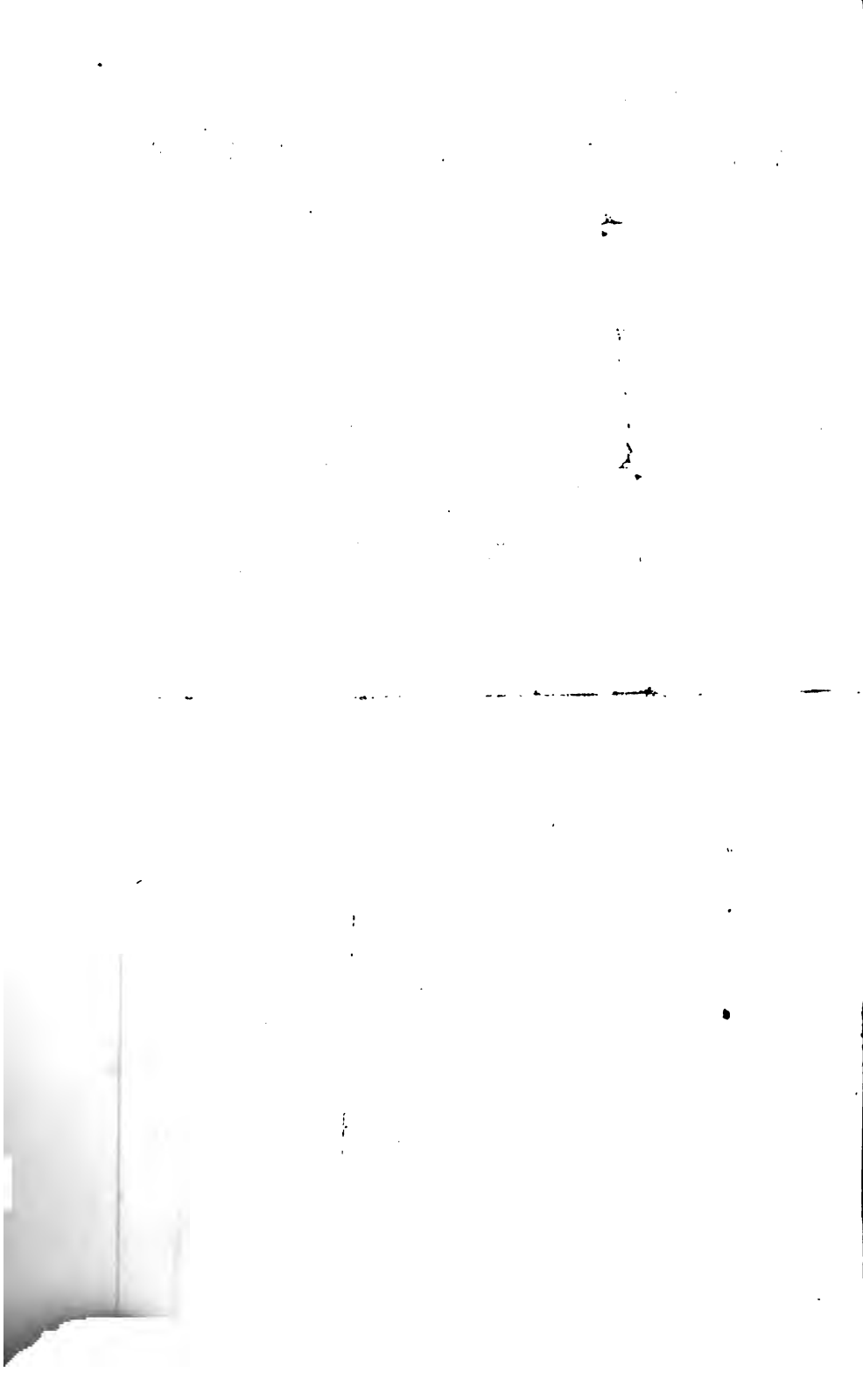
Two of the Horizontal Case

Mr. LADD will exhibit some  
in the North Gallery, at 8.  
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Tea and Coffee will be served

Visitors can only be admitted  
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OXFORD, 1860.

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OF  
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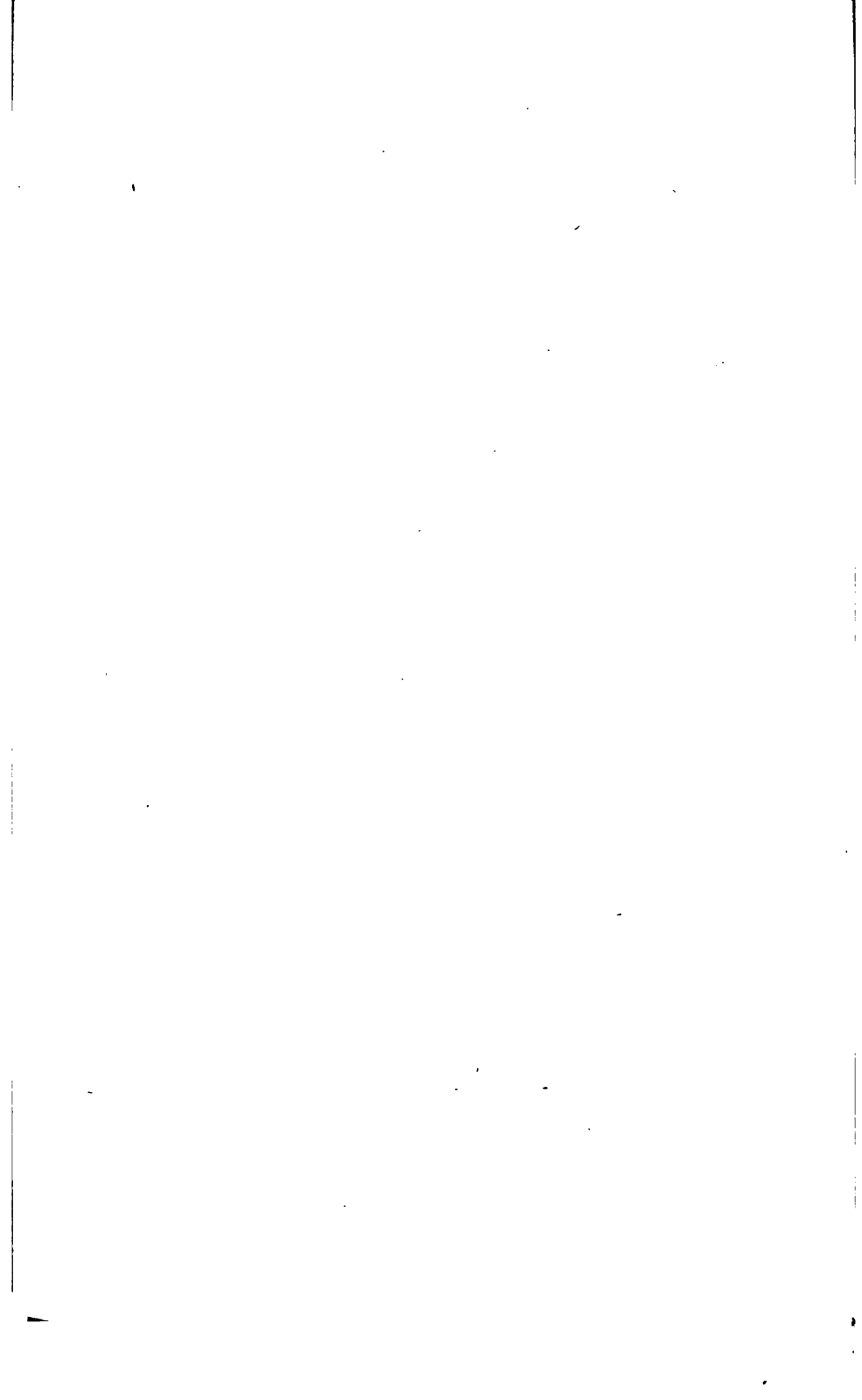
REGISTERED TO  
*THURSDAY, June 28, 8 p.m.*

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## I.

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## J.

- Jones, Thomas Rupert, F.G.S., Assist. Sec. Geological Society, London; Oriel College.
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- James, William, Sutton Road, Plymouth; 113, High Street.
- James, Edward, Plymouth; 113, High Street.
- Jeffreys, J. Gwyn, F.R.S., London; Lincoln College.
- Jukes, J. Beete, M.A., F.R.S., Director of the Geological Survey in Ireland; Stephen's Green, Dublin; Magdalen.
- Jones, Robert F., Stratford-on-Avon.
- Jellett, Rev. John H., Trinity College, Dublin; Balliol College.
- Jones, C. W., Cheltenham.
- Jenne, Rev. F., D.C.L., Vice-Chancellor of the University of Oxford; Pembroke College.
- James, Edward H., 9, Gascoyne Terrace, Plymouth; 113, High St.
- Jackson, James E., Tullydory, Blackwater Town, Armagh;
- Jardine, Sir William, Bart., F.R.S.E., Applegarth, Lockerby; Brasenose College.
- Jarrett, Rev. Professor, M.A., Cambridge.

## K.

- Ker, A. A. Murray, Newbliss House, Newbliss, Ireland.
- Kemp, Rev. H. W., B.A., Hull; Long Wall.

- Kirshaw, John William, F.G.S., Warwick; Park Crescent.  
 King, Joseph, Anfield Road, Liverpool.  
 Knowles, E. R. J., Belvidere House, Ryde, Isle of Wight.  
 Kinahan, Dr. G. Henry, Geological Survey of Ireland, 51, Stephen Green,  
 Dublin.  
 King, William Poole, Clifton, Bristol.  
 Knipe, J. A., Portobello; 45, St. Aldate's.

## L.

- Le Cappelain, John, Highgate, London.  
 Lister, John, M.D., F.G.S., Shibden Hall, near Halifax; Ship Street.  
 Laing, David, F.S.A. Scot., Edinburgh; Mitre Hotel.  
 Ladd, William, Chancery Lane, London; 51, Holywell Street.  
 Liveing, G. D., St. John's College, Cambridge; Jesus College.  
 Lister, Rev. William, Bushbury, Wolverhampton; Ship Street.  
 Lubbock, John, High Elms, Farnborough, Kent; 14, New Inn Hall St.  
 Lingard, J. R., F.G.S., Stockport, Cheshire.  
 Ley, Rev. Jacob, Staverton near Daventry; Ch. Ch.  
 Livingston, Rev. Thomas Gott, M.A., Minor Canon of Carlisle Cathedral,  
 6, Victoria Place, Carlisle; Magdalen Hall.  
 Lemprière, Charles, D.C.L., St. John's College.  
 Liddell, The Very Rev. Henry G., D.D., Dean of Ch. Ch.  
 Lee, John, LL.D., F.S.A., F.R.A.S., Hartwell House near Aylesbury;  
 77, George Street.  
 Lassell, William, F.R.S., F.R.A.S., Bradstones, Sandfield Park near  
 Liverpool; St. Mary Hall.  
 Lassell, William, Junr., Tue Brook, near Liverpool; St. Mary Hall.  
 Lupton, Arthur, Newton Hall, Leeds; Telfer's, Corn Market.  
 Lingwood, R. M., M.A., F.L.S., F.G.S., Ross, Herefordsh.; Star Hotel.  
 Lyell, Sir Charles, M.A., D.C.L., F.R.S., F.G.S., London; Jesus Coll.

## M.

- M'Laren, Archibald, Summertown, Oxon.  
 Macbride, Rev. John, D.C.L., F.R.S., F.G.S., Principal of Magd. Hall,  
 and Lord Almoner's Reader in Arabic in the University of Oxford  
 Magdalen Hall.  
 Michell, Rev. Richard, B.D., Prælector of Logic, Lincoln College; St. Giles'  
 Street.  
 Milman, Very Rev. H. H., Dean of St. Paul's, London; Cuddesden  
 Palace.  
 Moorsom, Admiral, Highfield, Binningham; High Street.  
 Matthews, Rev. R. B., Shalford, near Guildford; Ch. Ch.  
 Moffat, John, Ardrossan; 90, St. Aldate's.  
 Moore, Rev. W. Prior, The College, Cavan, Ireland.  
 Milner, William R., Wakefield, Yorkshire; Cross Hotel.

- Mackinlay, David, Pollokshields, Glasgow.  
 Miller, W. A., M.D., F.R.S., Professor in Chemistry in King's College, London; Magdalen College.  
 Morris, Rev. F. O., B.A., Hayton, York; Worcester College.  
 Maxwell, James Clerk, Professor of Natural Philosophy in Marischal College, Aberdeen; All Souls.  
 Malahide, The Lord Talbot de, Ireland; Ch. Ch.  
 Moseley, Rev. Henry, M.A., F.R.S., Canon of Bristol.  
 Monk, Rev. William, M.A., Aubrey Villa, Cambridge; St. Mary Hall.  
 Marriott, William, Huddersfield.  
 Mould, Rev. J. G., B.D., Bath; Headington.  
 Moore, Arthur, Dublin; 5, Beaumont Street.  
 Millar, John, Lisburn, Ireland; 138, High Street.  
 Moore, Charles, F.G.S., Cambridge Place, Bath; 38, High Street.  
 Morton, George H., F.G.S., Liverpool.  
 Mitchell, John Mitchell, Mayville, Edinburgh; Star Hotel.  
 McConnel, James, Manchester; King's Arms Hotel.  
 M'Andrew, Robert, F.R.S., Isleworth House, Isleworth, London; Mitre Hotel.  
 More, Professor John Schank, LL.D., F.R.S.E., Edinburgh University; Mr. Mason's, 77, George Street.  
 Macrory, Edmund, Fig-tree Court, Temple, London; Exeter Coll.  
 Murley, Rev. C. H., South Petherton, Ilminster; 4, Park Street.  
 Moore, John, Back Hall, Bristol; 13, Long Wall Street.  
 Macdonald, Professor William, M.D., F.R.S.E., F.L.S., St. Andrew's, N.B.; Pembroke College.  
 Macrory, Adam J., Duncairn, Belfast; Star Hotel.  
 Milnes, Richard M., M.P., Upper Brook Street, London; Cuddesdon, V. Pres.  
 Murchison, Sir Roderick I., G.C.St.S., D.C.L., V.P.R.S., F.G.S., F.L.S., F.R.G.S., Director General of the Geological Survey of the United Kingdom; The Deanery, Ch. Ch.  
 Monteagle, Lord, F.R.S., F.S.A., London: Rev. Canon Stanley's.  
 M'Clelland, James, Glasgow; Star Hotel.

## N.

- Northcote, A. Beauchamp, F.C.S., Rose Hill Terrace, Worcester; Queen's College.  
 Neate, Charles, M.A., Professor of Political Economy; Oriol College.  
 Neild, William, Manchester; Angel Hotel.  
 Ninnis, Paul, 120, High Street.  
 Napier, Right Hon. Joseph, Merrion Square, Dublin: All Souls.  
 New, Herbert, Evesham, Worcestershire; 4, Holywell Street.  
 Newton, Alfred, M.A., F.L.S., Fellow of Magdalen College, Cambridge, Elveden Hall, Thetford; Lincoln College.  
 Nasmyth, James, Penshurst, Kent; Pillinger's, Park Street.



## O.

- Ogilvie, Dr. George, Lecturer on Institutes of Medicine, Marischal College, Aberdeen ; Queen's College.  
 O'Leary, Purcell, A.M., Cork ; 12, Holywell Street.  
 Owen, Richard, M.D., LL.D., F.R.S., F.L.S., F.G.S., Director of the Natural History Departments in the British Museum, Fullerian Professor of Physiology in the Royal Institution of Great Britain, London ; Cuddesden Palace.  
 Outram, Thomas, Greetland, near Halifax ; Golden Cross.  
 Oldham, James, C.E., Austrian Chambers, Hull ; Golden Cross.  
 Ormerod, T. T., Brighouse near Halifax ; Park Nursery.  
 Orr, Sir Andrew, Blythwood Square, Glasgow.  
 Oxford, The Lord Bishop of, F.R.S., F.S.A., Cuddesden Palace.  
 Orpen, John H., LL.D., M.R.I.A., Stephen's Green, Dublin ; Exeter College.

## P.

- Phillips, John, M.A., LL.D., F.R.S., F.G.S., Professor of Geology in the University of Oxford, (*Assistant General Secretary*) ; Museum House.  
 Price, Rev. B., F.R.S., F.R.A.S., Sedleian Professor of Natural Philosophy in the University of Oxford ; St. Giles'.  
 Pusey, J. E. Bouverie, Ch. Ch.  
 Prestwich, Joseph, F.R.S., Treas. G.S., London ; Exeter College.  
 Pearsall, J. T., Mechanics Institution, Chancery Lane, London.  
 Perkins, Rev. R. B., B.C.L., Wotton-under-Edge ; Headington.  
 Pugh, William, Coalport ; Brasenose College.  
 Procter, William, York.  
 Pengelly, William, F.G.S., Lamorna, Torquay.  
 Purdy, Frederick, F.S.S., Victoria Road, Kensington.  
 Portlock, Major-General J. E., R.E., LL.D., F.R.S., F.G.S., London ; at the President's, Trinity College.  
 Pouden, Captain, Junior United Service Club, London : Star Hotel.  
 Plumptre, Rev. F. C., D.D., Master of University College, Oxford.  
 Peyton, Abel, Birmingham ; 116, High Street.  
 Phillippis, Sir Thomas, Bart., M.A., F.R.S., Middle Hill, Broadway, Worcestershire ; King's Arms.  
 Pearson, Charles, Coleford, Gloucestershire ; Ship Inn.  
 Porter, H. J. Ker, Brampton Park, Hants : 132, High Street.

## R.

- Robinson, Admiral Robert Spencer, 86, Eaton Place, London ; Ch. Ch.  
 Randolph, Rev. Herbert, M.A., Marcham, near Abingdon ; Ch. Cl.  
 Rolleston, George, M.D., F.L.S., Linacre Professor of Physiology ; New Inn Hall Street. (*Local Secretary*).  
 Rogers, James E. Thorold, Professor of Economic Science and Statistics in King's College, London ; Wellington Place.

- Ritchie, George Robert, 24, Stockwell Park Road, Stockwell, London ; 4, Cowley Place.
- Radcliffe, Charles Bland, M.D., 4, Henrietta Street, Cavendish Square, London ; Exeter College.
- Redwood, Isaac, Cae Wern, near Neath, South Wales : 77, George St.
- Radford, William, M.D., Sidmouth.
- Richardson, Sir John, C.B., M.D., LL.D., F.R.S., Lancrigg, Grasmere, Westmoreland ; 63, St. Giles'.
- Rand, John, Wheatley Hill, Bradford ; 88, High Street.
- Rowney, Thomas H., Ph.D., Professor of Chemistry in Queen's College, Galway ; 11, Ship Street.
- Ross, Admiral Sir James C., D.C.L., F.R.S., F.R.A.S., Aston Abbots, Aylesbury.
- Rathbone, Theodore W., Allerton Priory, near Liverpool ; 47, Walton St.
- Roget, P. M., M.D., F.R.S., F.G.S., F.R.A.S., London ; Magdalen Coll.
- Ratcliff, Charles, F.L.S., F.G.S., F.R.G.S., Downing College, Cambridge ; Brasenose College.
- Russell, W. J., Ph.D., Edgbaston, Birmingham.
- Ross, J. Coulman, Wadworth Hall, Doncaster ; Queen Street.
- Roberts, Richard, C.E., Adam Street, Adelphi, London ; Maidenhead Hotel.
- Rennie, Sir John, F.R.S., London ; Magdalen College.
- Rennison, Rev. Thomas, M.A., Queen's College.
- Reeve, Lovell, F.L.S., F.G.S., London ; 34, High Street.
- Roberts, Henry, F.S.A., London ; Star Hotel.
- Rogers, H. D., F.R.S., F.G.S., Professor of Natural History in the University of Glasgow ; Balliol College.
- Round, Daniel G., Hange Colliery, Staffordshire ; 33, Beaumont Street.
- Rankine, W. J. Macquorn, LL.D., F.R.S.L., F.R.S.E., Professor of Engineering, Glasgow ; Oriel College.
- Rivaz, Charles, Hyde Park, London ; Angel Hotel.
- Robinson, Charles B., The Shrubbery, Leicester.

## S.

- Smith, Henry J. S., M.A., F.C.S., Balliol College. (*Local Secretary.*)
- Shuttleworth, Sir James Kay, Bart., F.R.G.S., Gawthorp Hall, Burnley.
- Shuttleworth, John, Wilton, Polygon, Cheetham Hill, Manchester.
- Saunders, William, Magdalen Hall ; Manor House, Iffley, near Oxford.
- Spiers, Mr. Alderman, F.S.A., 14, St. Giles' Street.
- Symonds, Frederick, F.R.C.S., Oxford.
- Senior, George, Barnsley ; Star Hotel.
- Sloper, George E., Jun., Devizes ; 80, Holywell Street.
- Sloper, Samuel W., Devizes ; 80, Holywell Street.
- Strickland, H. E., Apperley Court, Gloucestershire ; Mitre Hotel.
- Stevelly, John, LL.D., Professor of Natural Philosophy in Queen's College, Belfast ; Worcester College.
- Salter, John W., F.G.S., Museum, Jermyn St., London ; Worcester Coll.

- Smith, Henry A., East Craibstone Street, Aberdeen; Roebuck Hotel.  
 Stewart, Balfour, Kew Observatory, Richmond, Surrey.  
 Stuart, William Henry, Birkenhead; Star Hotel.  
 Siemens, C. W., Westminster; St. Mary Hall.  
 Stoney, Bindon B., M.R.I.A., Dublin; Pembroke College.  
 Salmon, Rev. George, Trinity College, Dublin; Balliol College.  
 Slater, P. L., M.A., Secretary to the Zoological Society, London.  
 Shaw, Norton, M.D., Secretary to the Royal Geographical Society, London; St. John's College.  
 Smith, Edward, M.D., F.R.S., London; Ch. Ch.  
 Scoffern, John, M.B., London; High Street.  
 Stafford, the Marquis of, London.  
 Smith, William, C.E., Salisbury Street, Strand, London.  
 Symons, G. J., Camden Town, London; St. Giles' Fields.  
 Strang, John, LL.D., Glasgow.  
 Sutherland, A. J., M.D., F.R.S., Richmond Terrace, London; Ch. Ch.  
 Solly, S. R., M.A., F.R.S., F.G.S., London; Merton College.  
 Sheppard, Rev. H. W., M.A., Hemsworth, Hants; Wadham College.  
 Stokes, G. G., M.A., D.C.L., Sec. R. S., Lucasian Professor of Mathematics in the University of Cambridge; Pembroke College.  
 Smyth, John, Milltown, Banbridge, Ireland; Star Hotel.  
 Scholes, T. Seddon, Leamington.  
 Stainton, J. J., F.C.S., Lewisham, Kent; Angel Hotel.  
 Stenhouse, John, LL.D., F.R.S., London; Pembroke College.  
 Sullivan, Dr. W. K., Professor of Chemistry to the Catholic Univ. of Ireland, and the Museum of Irish Industry, Dublin; 31, Broad Street.  
 Sloper, S. Elgar, Winterton, near Southampton.  
 Symonds, Rev. W. S., F.G.S., Pendock Rectory; 7, Beaumont Street.  
 Stainton, H. T., Mountsfield, Lewisham, Kent.  
 Sharpey, William, M.D., Sec. R.S., F.R.S.E., Professor of Anatomy in University College, London; Woburn Place, London.  
 Smith, James, Seaforth, Liverpool; 66, Holywell.  
 Satterfield, Joshua, Alderley Edge; 21, High Street.  
 Selwyn, Rev. Professor, M.A., Cambridge.  
 Sedgwick, Rev. Adam, M.A., F.R.S., F.G.S., Woodwardian Professor of Geology in the University of Cambridge; Prof. Phillips's, Museum House.  
 Stanley, Rev. A. P., D.D., Canon of Ch. Ch.; Ch. Ch.  
 Symons, William, Dunster, Somerset; Roebuck Hotel.  
 Stoney, G. Johnstone, M.R.I.A., Secretary to the Queen's University of Ireland, Dublin Castle; Pembroke College.  
 Spottiswoode, William, M.A., F.R.S., London; Balliol College.  
 Sylvester, J. J., M.A., F.R.S., Professor of Mathematics, Royal Military Academy, Woolwich; Balliol College.  
 Sanders, William, F.G.S., Clifton, Bristol.  
 Simpson, William, Hammersmith, London.

Sprague, T. B., M.A., Liverpool and London Insurance Company,  
Poultry, London ; Mitre Hotel.

## T.

Thomson, Alexander, Banchory House, Aberdeen.  
Thomson, Guy, Oxford.  
Tristram, H. B., M.A. Oxon., F.L.S., Castle Eden, Durham ; Lincoln  
College.  
Taylor, John, jun., F.G.S., Queen Street Place, Upper Thames Street,  
London.  
Taylor, Richard, F.G.S., Queen Street Place, Upper Thames Street,  
London.  
Tite, William, M.P., F.R.S., London ; Queen's Hotel.  
Thurnam, John, M.D., Asylum, Devizes ; Pembroke College.  
Thompson, Thomas, Town Clerk, Hull.  
Tuckett, Frederick, Mortimer Street, London.  
Trevelyan, Sir Walter C., Wallington, Newcastle-on-Tyne ; 37, Broad St.  
Thornton, Samuel, Highgate, Birmingham ; 37, Holywell Street.  
Tennant, James, F.G.S., Professor of Geology and Mineralogy in King's  
College, London ; Merton College.  
Townsend, John, Burlington Street, Bath ; Balliol College.  
Tuton, Edward S., Liverpool.  
Thorburn, Rev. W. R., Starkies, Bury, Lancashire ; 10, Oriel Street.

## V.

Varley, Cornelius, Kentish Town, London.  
Vivian, Edward, B.A., Woodfield, Torquay ; Exeter College.  
Vallack, Rev. B. W. S., Budeaux near Plymouth ; 49, Broad Street.

## W.

Wrottesley, The Lord, M.A., V.P.R.S., F.R.A.S., Wrottesley Hall, Wol-  
verhampton ; the Vice-Chancellor's. (*President.*)  
Walker, Rev. Robert, M.A., F.R.S., Professor of Experimental Philoso-  
phy in the University of Oxford ; Wadham College. (*General Se-  
cretary.*)  
Wight, Robert, M.D., F.R.S., F.L.S., Grazeley Lodge, Reading ; 30,  
St. Giles'.  
Westwood, John O., M.A., F.L.S., Henley House, Summertown.  
Wilson, Frederick, J., Dallam Tower, Milnthorpe, Westmoreland ; 2,  
Adelaide Street.  
Whitaker, William, B.A., F.G.S., of the Geological Survey, London ;  
122, High Street.  
Whewell, Rev. William, D.D., V.P.R.S., Hon. M.R.I.A., F.R.A.S., Mas-  
ter of Trinity College, Cambridge ; Oriel College.

- Woodhead, G., Mottram, near Manchester ; Star Hotel.  
 Walker, F. J., Little Matford, St. Leonard's near Exeter ; Star Hotel.  
 Wood, Rev. H. H., Holwell Rectory, Sherborne ; Queen's College.  
 Walton, Thomas T., Clifton, Bristol ; Merton College.  
 Wood, Rev. W. S., M.A., Oakham, Rutlandshire ; 36, Holywell Street.  
 Willis, Rev. Robert, M.A., F.R.S., F.G.S., Jacksonian Professor of Natural and Experimental Philosophy in the University of Cambridge ; the Rev. Canon Stanley's.  
 Waddingham, John, Winchcomb, Gloucestershire ; Mitre Hotel.  
 Wilde, Henry, Engineer, Manchester ; Golden Cross.  
 Wood, George, Bradford ; University College.  
 Wright, E. Perceval, A.M., M.B., F.L.S., Dublin University ; Jesus College.  
 Wright, Thomas, F.S.A., Brompton, London ; Pembroke College.  
 Watts, John King, F.R.G.S. and F.E.S., St. Ives ; George Street.  
 Wright, Henry, Erith, Kent.  
 Walker, James, C.E., LL.D., F.R.S.L. and E., Westminster.  
 Wright, T. G., M.D., Wakefield ; Cross Hotel.  
 Wilson, Professor John, F.R.S.E., F.G.S., Edinburgh ; 86, St. Aldate's.  
 Whiteside, Rev. J. W., LL.D., Vicarage, Scarborough ; Queen's College.  
 Wheatstone, Charles, F.R.S., Professor of Experimental Philosophy in King's College, London.  
 Willet, John, C.E., Albyn Place, Aberdeen.  
 Walton, Rev. W., M.A., F.R.S., Great Moulton, Norfolk.  
 Waterhouse, Nicholas, Rake Lane, Liverpool.  
 Wilkinson, Robert, Totteridge Park, Herts ; Balliol College.  
 Woodall, Captain J. W., M.A., F.G.S., Scarborough ; Oriel College.  
 Wardle, Thomas, Leek, Staffordshire ; Holywell Street.  
 Wornell, George, Reading ; 2, Park Crescent.  
 Wheeler, Edmund, Holloway, London ; 43, Queen Street.

## Y.

- Yeates, George, M.R.I.A., Dublin ; 3, St. John's Street.  
 Yarborough, George C., Doncaster ; 104, High Street.

# BRITISH ASSOCIATION,

OXFORD, 1860.

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LIST OF  
RESIDENT AND NON-RESIDENT  
**ASSOCIATES.**

*Registered to THURSDAY, June 28, Eight P.M.*

---

A.

- Andrews, William Ryton, Wadham College.  
Adolphus, John Leycester, 12, Hyde Park Square, London; St. John's College.  
d'Audigne, Le Marquis de, Military Attachè of the French Embassy, G. Dayman's, Esq., Summertown, near Oxford.  
Asquith, J. R., Leeds; Ship Inn, Ship Street.  
Abbott, Samuel, Liverpool; 37, Beaumont Street.  
Allen, Rev. William, Oxford.  
Ashworth, John A., Non-Resident, Brasenose College.  
Atkinson, John Balfour, 8, Royal Terrace; 58, St. John Street.  
Ashhurst, John Henry, Waterstock.  
Ashhurst, James Henry, Waterstock Rectory, Oxon.  
Albright, John Marshall, Charlbury.  
Anderson, Thomas, M.D., F.L.S., Bengal Army, Calcutta; Magdalen College.  
Atkinson, Rev. G. B., M.A., Trinity Hall, Cambridge; Brasenose College.  
Ancrum, W. Rutherford, 75, Inverness Terrace, Kensington Gardens, London; Christ Church.  
Anderson, Sir Charles, Bart., Lea; Cuddesdon.

B.

- Boase, Dr. Henry, Claverhouse, Dundee; Exeter College.  
Boase, Rev. C. W., M.A., Exeter College.  
Banister, Rev. William, B.A., Liverpool; Mr. Walsh's, 41, Queen St.  
Bathurst, Rev. William Hiley, Darley Dale, Matlock, Derbyshire; 1, Merton Street.  
Brancher, Rev. Henry, Thursley, Godalming; Kettel Hall, Broad St.  
Browne, Rev. T. C., 59, High Street.  
Bayne, Rev. T. Vere, M.A., Ch. Ch.

- Butler, Edwin, Carfax.  
 Briscoe, John, Broad Street.  
 Boyd, Robert, 49, Cambridge St., Hyde Park ; 7, Beaumont St.  
 Bloxam, Rev. J. R., D.D., Magdalen College.  
 Barber, William, M.A., Worcester College.  
 Bewick, Joseph, Grosmont, near Whitby ; 16, Merton Street.  
 Barwis, Rev. W. C.  
 Bull, Rev. Henry, Lathbury, Bucks ; 20, St. Giles's, Oxford.  
 Baker, William, Broad Street.  
 Bigsby, John Jeremiah, M.D., F.G.S., 89, Gloucester Place, Portman Square, London ; Lacy's, Broad Street.  
 Brunner, William, 11, Beaumont Street.  
 Barnes, Rev. Wm. C., Chipping Norton, Oxon. ; 8, Long Wall St.  
 Barlow, Peter W., F.R.S., Blackheath ; Mr. Shrimpton, Market Place.  
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 Bathurst, Charles, Darley Dale, Derbyshire ; Ch. Ch.  
 Bridges, James, Royal Military Academy, Woolwich ; 43, St. Giles' Street.  
 Blades, William, 11, Abchurch Lane, London ; Summertown House.  
 Bird, Henry, Cheltenham.  
 Baron, Rev. John, M.A., Upton Scudamore, Warminster, Wilts ; Queen's College.  
 Bose, Carl Moritz von, Red Hill, Surrey ; Exeter College.  
 Blair, Alexander, LL.D., 34, Queen Anne Street, London ; Wadham College.  
 Bathurst, Hon. Wm. Lennox, M.A., Fellow of All Souls' College.  
 Bosanquet, R. Holford Macdowall, Balliol College.  
 Browning, Jonathan Samuel, Oxford.  
 Bickersteth, The Archdeacon, Prebendal House, Aylesbury ; Ch. Ch.  
 Brown, Thomas Crowther, Cirencester ; 15, Beaumont Street.  
 Bowman, Edward, M.A., Manchester.  
 Butler, Thomas, Magdalen College.  
 Bulley, Dr., President of Magdalen College.  
 Bulley, Captain John, Magdalen College.  
 Burnes, James, M.A., LL.D., K.H., F.R.S., Junior United Service Club, London.  
 Bennett, George, M.D., F.L.S., Sydney, N. S. Wales, and 22, Eastbourne Terrace, London ; Roebuck Inn.  
 Briscoe, Rev. Richard, D.D., Whitford, near Holywell ; Jesus Coll.  
 Bowly, David, Seddington, Cirencester ; Mitre Hotel.  
 Bell, William, M.A., Inner Temple, London ; Exeter College.  
 Bosworth, Frederick, Bristol.  
 Barclay, Frederick K., Bury Hill ; Mitre Hotel.  
 Baumert, Maurice, Bonn ; Exeter College.  
 Brown, Thos. B. Welchpool, Montgomeryshire.  
 Barclay, Robert, Leyton, Essex ; 18, Ship Street.

Badcock, Benjamin, Headington Hill.  
 Brine, Rev. James, Chardstock ; Ch. Ch.  
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 Bevan, William Henry Rawlinson, Plumpton, Bury St. Edmund's ;  
 Professor Donkin's.  
 Bannatyne, Rev. Charles, Aldham Rectory, Colchester ; Balliol  
 College.  
 Bernard, Mountague, B.C.L., All Souls' College.  
 Baxter, Henry Elmhirst, Worcester College.

## C.

Chadwick, J. W., Woodhouse Cliff, Leeds ; Queen's College.  
 Chambers, Rev. William, M.A., Worcester College.  
 Cholmeley, Rev. C. Humphrey, M.A., Magdalen College.  
 Cradock, E. H., D.D., Principal of Brasenose College.  
 Cavell, John Caldecott, 12, Magdalen Street.  
 Cornthwaite, Rev. Tullie, Walthamstow ; Dickeson's, Broad Street.  
 Clark, William George, Fellow of Trinity College, Cambridge ; Wad-  
 ham College.  
 Christopher, Rev. Alfred M. W., M.A., Rector of St. Aldate's, Rich-  
 mond Lodge.  
 Cattley, Edward Abbs, 15, Amptill Square, London ; 98, Holywell St.  
 Caffin, Rev. B. C., M.A., Worcester College.  
 Coxe, Rev. Henry Octavius, M.A., 17, Beaumont Street.  
 Cogan, Joseph, M.D., Wheatley, Oxford.  
 Cure, Rev. Edward Capel, M.A., Fellow of Merton College.  
 Clarke, Rev. Thomas, Wood Eaton.  
 Cholmeley, Rev. James, M.A., Fellow of Magdalen College.  
 Corfe, Charles John, 4, Merton Street, Oxford.  
 Cox, G. V., M.A., 34, High Street.  
 Cox, Rev. J. C., M.A., High Street.  
 Crowdy, Charles Whitton, Physician, Bath ; 18, St. John Street.  
 Combe, Thomas, M.A., University Press.  
 Cooper, Rev. John, M.A., Fellow of Wadham College.  
 Curtia-Hayward, J. F., Quedgeley, Gloucestershire.  
 Carey, Peter Stafford, M.A. of St. John's College, Oxon, Bailiff  
 of Guernsey, Guernsey ; Angel Inn.  
 Cobb, Rev. Robert, Rector of Ellingham, Norfolk ; Magdalen  
 College.  
 Caswell, Rev. Alexis, Professor of Natural Philosophy and Astro-  
 nomy, Brown University, Providence, R.I., U. S. ; Star Hotel.  
 Constable, John, Royal Agricultural College, Cirencester ; 116,  
 High Street, or New College.  
 Cutler, Eldridge J., A. M., New York, U. S. America, Grace's  
 Hotel.  
 Collingwood, Samuel, University Press ; Summertown House.  
 Campbell, —, St. John's College.



- Collett, Rev. Anthony, 2, Camden Crescent, Dover; Exeter Coll.  
 Crapper, Josiah Munday, 47, St. John's Street.  
 Corrie, Rev. E. S.  
 Carey, E., Wednesdock.  
 Churton, Rev. T. T., West Shefford, Berks; 6, Holywell.  
 Connell, James, Oxford.  
 Cole, W. Cole, Exmouth, Devon; 11, St. Giles's.  
 Castle, Nathaniel, J. P., 13, High Street.  
 Churchill, Henry, Deddington, Oxon.  
 Croker, T. F. Dillon, F.S.A., 19, Pelham Place, Brompton, London.  
 Clarke, Wm. Fairlie, B.A., National Club, London; Ch. Ch.  
 Campion, Rev. W. M., B.D., Fellow of Queen's Coll., Cambridge;  
     St. Peter's College, Radley.  
 Cardwell, Rev. Edward, D.D., St. Alban's Hall.  
 Collins, Rev. William Lucas, M.A., Great Houghton, Northamp-  
     ton; Jesus College.  
 Clutterbuck, Rev. James Charles, M.A., Long Wittenham, Berks;  
     Exeter College.  
 Carlyle, Rev. John, Noke, Oxon.  
 Curling, Henry, Ramsgate; 32, Broad Street.  
 Cross, Richard, Corn Market Street.  
 Cogan, Dr. Bernard, London; Mitre Hotel.  
 Cousins, Edward, 11, Park Place, St. Giles's.  
 Cook, Edw. Wm., A.R.A., F.L.S., The Ferns, Hyde Park Gate  
     South, Kensington; Mr. Jas. Wyatt's, High Street.  
 Cooke, S. H., Great Budworth; Beckley.  
 Chatteris, William, Sandford Priory; Angel Hotel.  
 Cholmeley, Rev. Robert, D.D., Magdalen College.  
 Chalker, Rev. Frederick, M.A., Corpus Christi College.  
 Colthurst, Joseph, F.G.S., C.E., Dripsey Castle, Cork; 6, Ch. Ch.  
 Chretien, Rev. Charles P., M.A., Oriel College.

## D.

- Du Boulay, Thomas, West Lawn, Sandgate, Kent; Exeter College.  
 Davenport, John M., 62, St. Giles's Street.  
 Duckworth, Henry, F.R.G.S., F.G.S., Liverpool; Trinity College.  
 Dayman, Captain, R.N.  
 Dudley, John Crews, Solicitor, Oxford (Alderman).  
 Dodgson, Charles L., M.A., Ch. Ch.  
 Dry, William, Beaumont Street.  
 Dalby, Rev. William Byard, M.A., Fellow of Wadham College.  
 Denyer, William, 141, High Street.  
 Daman, Rev. Charles, Oxford.  
 Dicey, Albert Venn, B.A., Fellow of Trinity College.  
 Davenport, John D., 62, St. Giles's Street.  
 Dry, Richard Deane, 13, Merton Street.  
 Doyle, Mr. Justice, the Bahamas; Roebuck Hotel.

- Durham, Edward, Northampton; Queen's College.  
 Duckworth, Rev. Robinson, Trinity College.  
 Durell, D. V., M.A., 7, New Inn Hall Street.  
 Dashwood, Henry W., Dun's Tew.  
 Duns, David Alfred, Torphichen, Bathgate; 58, St. John's Street.  
 Durham, George Herbert, Queen's College.  
 Drummond, J., 74, High Street.  
 Dodd, Rev. Joseph, M.A., Hampton Poyle.  
 Dodd, Frederick, Hampton Poyle.  
 Dodd, Joseph, Hampton Poyle.  
 Du Boulay, James H., M.A., Exeter College.  
 Dallas, Eneas S., 6, Hanover Square, London; Alderman Spiers', St. Giles'.  
 Drew, Richard, W., B.A., Cambridge, 9, Pall Mall East, London; Balliol College.  
 Dixon, W. Hepworth, F.S.A., Athenæum Office, London; Mr. Alderman Spiers', 14, St. Giles'.

## E.

- Estridge, Rev. Henry, M.A., 13, Park Terrace, Oxford.  
 Elliott, Richard Henry, Worcester College.  
 Edwards, Andrew, Magdalen College.  
 Ellis, Robinson, M.A., Trinity College.  
 Eld, Rev. J. H., B.D., St. John's College.  
 Eld, George, Coventry; St. John's College.  
 Egerton, Edward C., M.P., 13, Lowndes Square, London; Dr. Ch. Ch.  
 Edmonds, Rev. George, M.A., Little Wenlock; Ch. Ch.  
 Evans, Thomas M., 19, Queen's Road West, Regent's Park, London; Mitre Hotel.  
 Evans, Thomas Saunders, M.A., (St. John's College, Cambridge,) Rugby; Merton College.  
 Ellis, L. A., Dover House, London.

## F.

- Fielkin, Robert, 21, Albert Road, London; 53, St. John's Street.  
 Farrar, Rev. Adam S., M.A., Queen's College.  
 Fell, Rev. George Hunter, D.D., Magdalen College.  
 Foster, George, Sabden, Lancashire; 53, St. John's Street.  
 Freeborn, Rev. J. W., Llanrwst, N. W.; 3, St. Giles's, Oxford.  
 Ferrers, Rev. N. M., M.A., Gonville and Caius College, Cambridge; Exeter College.  
 Fisher, Anthony Lax, M.D., 14, York Place, Portman Square, London; Roebuck Hotel.  
 Freemantle, Rev. William H., Lewknor, Oxfordshire; All Souls College.

Farmer, Rev. Henry Birch, Rector of Donaghmore, Queen's Co., Ireland.

Fosbery, Thomas Vincent, M.A., St. Giles' Vicarage, Reading; Cuddesdon Palace.

French, Alfred J., B.A., 4, North Parade Terrace.

Forbes, Hon. F. C., M.A., Oriel College.

Freeland, Alex. Bankier, 76, Camden Road Villas, London.

Finnie, Archibald, Springhill, Kilmarnock.

Fewtrell, W. T., F.C.S., London; Pembroke College.

Fowler, Rev. T., M. A., Lincoln College.

Fowler, Robert Nicholas, M. A., F.R.G.S., 50, Cornhill, London.

#### G.

Garside, Joseph, Merchant, Selby; Mr. Jones's.

Giles, Richard, M.D., High Street, Oxford.

Grey, William Hewett Charles, Wilford, near Nottingham; Roebuck Hotel, Oxford.

Glynn, Edward, London; 120, St. Aldate's Street.

Gandell, Rev. Robert, M.A., Holywell Lodge.

Gordon, Rev. Richard, Elsfield Vicarage, near Oxford.

Gray, Rev. John Hamilton, Bolsover Castle, Derbyshire; Rev. Dr. Millard's, 58, High Street.

Gorman, Thomas Murray, Belfast; Magdalen Hall.

Gregory, Rev. Benjamin, New Inn Hall Street.

Gurney, John Henry, M.P., Kensington Palace Gardens, London; Lincoln College.

Golightly, Rev. C. P., 6, Holywell Street.

Grafton, Charles, Oxford.

Gibb, G. D., M.D., F.G.S., 22, Portman Street, Portman Square, London.

Grindrod, R. B., M.D., LL.D., F.G.S., S.S. and R.G.S., Great Malvern; New College.

Godwin-Austen, Robert, F.R.S., G.S., Chilworth Manor, Guildford.

Gordon, Colonel, Royal Engineers; Lincoln College.

Gunn, John, Istead Rectory, Norfolk; Ch. Ch. (Dr. Jacobson's.)

Greenwood, Rev. H., M.A., Magdalen College.

Greer, Thomas, Dripsey, Cork; Ch. Ch.

Griffith, Samuel, Redlands, Bristol; Worcester Street.

Gordon, the Rev. Osborne, B.D., Student of Ch. Ch.

Griffin, Fred. C. G., Lincoln College.

Godman, Frederick Du Cave, 55, Lowndes Square, London; Corpus Christi College.

Green, J. R., 13, High Street.

#### H.

Hawtrey, Rev. Henry Courteney, M.A., Church House, Windsor, Berks; Professor Donkin's, Broad Street.

- Heurtley, Rev. Charles Abel, D.D., Canon of Ch. Ch., Margaret  
Professor of Divinity.
- Holmes, Alfred Green, 3, Park Crescent.
- Harvey, Rev. W. W.
- Hooper, Mr., Trinity College.
- Hull, Edward, B.A., F.G.S., Museum, Jermyn Street, London.
- Hussey, Edward Law, St. Aldate's.
- Humphreys, H. T., Woodview, Blackrock, Dublin.
- Hatch, H., Park Crescent.
- Hammond, George, M.A., Merton College.
- Hocking, Henry H., Streatham, Surrey; Rev. J. Rogers', St. Giles'.
- Harrison, George, Secretary to the Chamber of Commerce, Edinburgh, North Bridge, Edinburgh; Grandpont House.
- Hedley, Rev. William, M.A., University College.
- Hurford, Alexander Samuel, 14, Beaumont Street.
- Hackman, Rev. Alfred, M.A., Ch. Ch.
- Hillier, Thomas, M.D., 21, Upper Gower Street, London; 12,  
Magdalen Street.
- Hall, Henry, Barton.
- Hall, A. W., Barton.
- Hony, William Edward, Baverstock, Salisbury; Exeter College.
- Howard, John, Magdalen College.
- Harrison, M. J., H.M.S. Britannia.
- Hall, E. P., St. Giles'.
- Hawkins, Rev. Edward, D.D., Provost of Oriel College.
- Hawkins, Cæsar Richard, Oriel College.
- Hawkins, Cæsar H., Grosvenor Street, London; Oriel College.
- Hawkins, R. S., Southbourne.
- Howard, E. Stirling, Woodside, Sheffield; 120, High Street.
- Howard, William, Woodside, Sheffield; 120, High Street.
- Hulme, Rev. S. J., M.A., 1, Park Villas.
- Hall, Walter, 10, Pier Road, Erith.
- Hall, Edward, F.S.A., 8, St. John Street, Adelphi, London.
- Holdich, Thomas Peach, 22, Norland Square, Notting Hill, London;  
Balliol College.
- Holland, Rev. J. M., M.A., New College.
- Higginson, Rev. E., Swansea, 19, John's Street, Worcester Street.
- Hodgson, Richard, F.R.G.S., Essex.
- Herbert, William Fox, Nottingham.
- Herbert, Edward Gilbert, The Park, Nottingham.
- Hill, Albert, Bruce Castle, Tottenham; 31, St. John Street.
- Hill, Edwin, Bruce Castle, Tottenham; 31, St. John Street.
- Hawkins, Rev. Ernest, Pall Mall, London; Exeter College.
- Haddon, Frederick W., 12, St. James's Square, London (Assistant  
Secretary, Statistical Society of London).
- Holden, Rev. Henry, D.D., Durham; Balliol College.
- Hopkins, Rev. Thomas Henry Toovey, M.A., Magdalen College.

Hewlett, Alfred, M.A., Astley, near Manchester; 43, St. Giles'.  
 Hewitt, Dr. Graily, 17, Radnor Place, London; Lincoln College.  
 Hessey, Rev. R. F., M.A., Magdalen College.  
 Hunt, W. Holman, Tor Villa, Campden Hill, Kensington; Thomas  
 Combe's, Esq., Clarendon Press.

## I.

Ince, Rev. William, M.A., Exeter College.  
 Isaac, George Washington, Clifton; Summertown House.  
 Iles, John Hodgson, M.A., The Rectory, Wolverhampton; Lincoln  
 College.

## J.

Jelf, Rev. Dr., King's College, London, and Ch. Ch., Oxford.  
 Joyce, Rev. F. Hayward, M.A., Ch. Ch.  
 Jones, Rev. W. Basil, M.A., University College; 2, Park Crescent.  
 Jenkins, John D., B.D., Jesus College.  
 Jacobson, Rev. William, D.D., Ch. Ch.  
 Jacobson, W. B. R., Ch. Ch.  
 Jardine, Charles J., Jardine Hall; Magdalen Hall.  
 Johnson, William, F.R.A.S., Bicester.  
 Jones, Everard W., Gwynfryn; 2, Park Crescent.  
 Jowett, Rev. Benjamin, M.A., Balliol College.  
 James, Rev. William, Bristol.

## K.

King, Hon. R. G. N., University College.  
 Keene, Rev. Charles Edw. Ruck, Swyncombe House; Ch. Ch.  
 Kempe, Charles Eamer, Brighton; Pembroke College.  
 Kemp, Robert, Holloway, London; 48, Broad Street.  
 Kell, Captain, F.G.S., 112, Westbourne Terrace, London; Queen's  
 College.  
 Kirkman, Rev. Thomas P., M.A., F.R.S., Croft Rectory, near War-  
 rington; Balliol College.  
 Kell, William, F.S.A., Gateshead-on-Tyne; 11, Ship Street.

## L.

Lincoln, The Lord Bishop of, Riseholme Palace, Lincoln; Pembroke  
 or All Souls College.  
 Lambert, Rev. William, Pennington, near Lymington, Hants;  
 Exeter College.  
 Latimer, Sturman, Headington, Oxon.  
 Latimer, Digby, M.A., Lincoln College.  
 Latimer, Rev. William, Headington.  
 Lewis, Thomas, M.D., Picton Terrace, Carmarthen; 37, Holywell  
 Street.

- Ley, Rev. John, Sussex; Exeter College.  
 Loveday, Thomas, E. Ilsley, Berks; Rev. C. P. Golightly's.  
 Lace, Rev. John William, M.A., Cheltenham.  
 Lee, Thomas William, Redbrook, Whitchurch, Shropshire; Oriol College.  
 Laurie, William Alexander, F.S.A., Norland Castle, Fifeshire.  
 Lockhart, William, Blackheath; 1, Broad Street.  
 Lucas, William, Hitchin.  
 Lehmann, Frederick, 139, Westbourne Terrace, Hyde Park, London; Roebuck Hotel.  
 Lefroy, Charles Edward, Ewshot House, Farnham, Surrey; Ch.Ch.  
 Lightfoot, Rev. Dr., Exeter College.  
 Leighton, Rev. F. K., D.D., Warden of All Souls' College.  
 Lee-Warner, James, Trinity College.

## M,

- Mansel, Rev. Henry Longueville, 87, High Street, Oxford.  
 Menzies, Rev. Frederick, M.A., Fellow of Brasenose College.  
 Martin, John, M.R.C.S., L.S.A., St. Clement's, Oxford.  
 Money, Gilbert P., Shalford, Guildford; Ch. Ch.  
 Main, Rev. Robert, M.A., F.R.S., Pres. R.A.S., and Radcliffe Observer, Radcliffe Observatory; Pembroke College.  
 Monk, Rev. William, M.A., Aubrey Villa, Cambridge; St. Mary Hall.  
 Morrall, Rev. Cyrus, Northleigh Vicarage, Oxon; Brasenose Coll.  
 Millar, Robert, 9, Rose Angle, Dundee, N. B.  
 Maurice, Rev. Peter, D.D., Vicarage, Yarnton; 25 Beaumont St.  
 McDonnell, Robert, M.D., M.R.I.A., Dublin; Pembroke College.  
 Masling, Charles, Stanley Park, Stroud; 131, High Street.  
 Mackintosh, Robert James, M.A., Oxford, 2, Hyde Park Terrace, Kensington Gore, London; King's Arms Hotel.  
 Mayo, C., B. A., New College.  
 McClintock, John, Drumcar, Ireland; Exeter College.  
 Mills, J. R., Kingswood Lodge, Englefield Green.  
 Morris, John, F.G.S., Professor of Geology and Mineralogy in University College, London; Oriol College.  
 Marshall, Rev. Jenner, Westcott Barton Manor.  
 Masters, Maxwell T., Lecturer on Botany, St. George's Hospital, London; Botanic Garden.  
 Mayer, Joseph, F.S.A., Liverpool.  
 Mayor, Robt. Bickersteth, B.D., Rugby; Merton College.  
 Munro, Colonel William, C.B., F.L.S., 39th Regiment; 3, Alfred Street.  
 Morrison, Rev. W., M.A., Ch. Ch.  
 Mawer, John William, 4, High Street.  
 Marsham, R. B., D.C.L., Merton College.  
 Macray, John, Librarian of Taylor Institution, Oxford.

Metcalfe, Frederick, 22, Beaumont Street.  
 Medd, Rev. Peter Goldsmith, M.A., University College.  
 Medd, John, Stockport, Cheshire; University College.  
 Marling, Henry H., Stonehouse Court; Magdalen College.  
 Morton, Fred., Wrotesley.  
 M'Farlane, Rev. W., Dorchester.  
 Mackenzie, Augustus Colin, M.A., St. John's College, Findon,  
     Rosshire, N.B.; 10, St. Giles's.  
 Morrell, Frederick Parker, St. John's College.  
 Morrell, Frederick James, St. Giles's.  
 Malkin, A. T., 21, Wimpole Street, London; Jesus Lodgings.  
 Mattison, A., 1, Torrington Street, Russell Square, London.  
 Müller, Dr. H., 82, Gower Street, London.  
 Marsh, Rev. W. T., St. Leonards'-on-Sea.  
 Murling, Samuel Stephens, Stanley Park, Stroud; 131, High Street.  
 Marshall, Edward, 29, Beaumont Street.  
 Mallam, Thomas, St. Giles's Fields.  
 Molyneux, William, Trentham, Staffordshire; Nuneham Park.  
 M'Farlane, Rev. Edward M., Magdalen College.  
 Monitt, Robert, Liverpool.  
 Molesworth-St. Aubyn, Walter Stapleton, Ch. Ch.

## N.

Newcomb, Rev. C. George, M.A., Halberton Vicarage, Tiverton;  
     Cuddesden Vicarage, Wheatley.  
 Newby, Rev. H., M.A., Mears Ashby, Northampton; Worces. Coll.  
 Newbould, Rev. W. W., Turnham Pier.  
 Napier, Hon. and Rev. Henry Alfred, Swyncombe, Oxfordshire;  
     the President of Trinity's.  
 Nolloth, Matthew Stainton, St. Mary's Cottage, Peckham, Surrey.  
 Norman, Rev. R. W., M.A., Exeter College, Fellow of St. Peter's  
     College, Radley.  
 North, Thomas; Saint John Street, Oxford.  
 Newman, T. Harding, D.D., Fellow of Magdalen College.  
 Natly, John, M.D., Dublin.

## O.

Oxenham, Robert George, Exeter College.  
 Owen, Edward R., F.R.C.S., Beaumont Street.  
 Oxenham, Frank Nutcombe, Exeter College; 16, Park Crescent.  
 Oxenham, R. G., Exeter College.  
 Ormerod, Theodore, Brighouse, Yorkshire; Park Nursery.  
 Owen, Rev. Robert, B.D., Jesus College.  
 Ommanney, Captain Erasmus, R.N., United Service Club, Pall  
     Mall, London; Magdalen College.  
 Orpen, John R., Stephen's Green, Dublin.  
 Osborn, Captain Sherard, R.N., 24, Clifton Villas, Warwick Road,  
     London; the Deanery, Ch. Ch.

## P.

- Payne, Joseph Frank, Letherhead, Surrey; Magdalen College.  
 Payne, John Burnell, Letherhead, Surrey; Magdalen College.  
 Parsons, John, Old Bank, Oxford.  
 Parsons, Herbert, M.A., Old Bank, Oxford.  
 Pike, Robert, 2, St. Aldate's Street.  
 Perring, Albert Glenie, Queen's College.  
 Parker, John Henry, The Turl.  
 Parker, James, The Turl.  
 Pickard, Alfred, A. A., Boundary Terrace, Leeds.  
 Prior, Joseph, Corn Market Street.  
 Paddon, Charles Edward, Wadham College.  
 Prior, Robert, 6, Corn Market Street.  
 Pooley, Charles, M.R.C.S., Weston-super-Mare; 15, Beaumont St.  
 Pike, Lieut. J. W., R.N., J. U. S. Club; 14, New Inn Hall Street.  
 Petherick, John, F.R.G.S., H.M. Consul for London, 8, Cork Street,  
 Burlington Gardens, London; Balliol College.  
 Priestley, William Overend, M.D., 31, Somerset Street, Portman  
 Square, London; 79, High Street.  
 Pilson, Rev. Robert, Birts Morton Rectory, Worcestershire;  
 7, Beaumont Street.  
 Paine, William, Welchpool.  
 Pitcairn, David, B.A., Magdalen College.  
 Pike, James Burnett, Oxford.  
 Pickard, Rev. Henry Adair, M.A., Ch. Ch.  
 Prout, John W., Neasdon, Middlesex; Ch. Ch.  
 Prout, Rev. Thomas Jones, M.A., Student of Ch. Ch.  
 Parker, Charles Stewart, Esq., M.A., Fellow of University College.  
 Phelps, Henry, Dublin; Mitre Hotel.  
 Phelps, William, Monkstown, Co. Dublin; Mitre Hotel.  
 Pinnock, Rev. William Henry, D.C.L., Corpus Christi College,  
 Cambridge; Somersham Rectory, Hants: 16, St. Giles'.  
 Pritchard, Rev. C., F.R.S., F.P.R.A.S., Clapham, London; 85,  
 High Street.  
 Perkins, William Francis, 62, Holywell Street.  
 Palmer, H. T., Woodstock; Dr. Acland's.  
 Perowne, Rev. J. J. S., B. D., King's College, London; Queen's  
 Lodge, Oxford.  
 Perowne, Rev. Edward Henry, B.D., Tutor of C. C. C. Cambridge;  
 1, Park Villas, Oxford.  
 Polwhele, Thomas Roxburgh, 28, Jermyn St., London; 77, George St.  
 Pike, James, Oxford.  
 Prickett, Rev. T. W., Hull; Trinity College.  
 Patterson, Robert, Stanwix, near Carlisle.  
 Petrie, Captain Martin, Topographical Staff, Hanover Lodge, Ken-  
 sington Park, London; 57, St. Giles'.



## R.

- Rusher, William, Surgeon, 48, High Street.  
 Reinagle, Alexander Robert, Oxford.  
 Ryder, Richard C.W., M.A., 5, Victoria Street, Westminster; Wadham College.  
 Randall, Thomas, jun., Grandpont House, Oxford.  
 Randall, Thomas, Mayor of Oxford, Grandpont House.  
 Robertson, Alister Stuart, M.D., Kingussie, Inverness; Roebuck Hotel.  
 Rose, John, 2, High Street.  
 Ross, Charles Douglas, M.A., Wadham College.  
 Rumsey, Rev. James, M.A., St. Mary Hall.  
 Ramsay, Alexander, jun., 45, Norland Square, London; 14, Beaumont Street, Oxford.  
 Russell, Rev. A. Norris, Beachampton Rectory, Bristol.  
 Rawlinson, Rev. George, M.A., 53, Broad Street, Oxford.  
 Rae, John, M.D., F.R.G.S., C.M.Ny. G.S., Toronto, Canada West. 66, Holywell Street.  
 Ryder, Alfred P., Capt. R.N., London; Wadham Coll.  
 Rose, Caleb B., F.G.S., Gt. Yarmouth.  
 Risley, Rev. William Cotton, M.A., Deddington, Oxfordshire.  
 Randall, The Archdeacon, Binfield, Berks; Cuddesdon Palace.  
 Rickman, W. C., A.I.C.E., Empshot, Petersfield; Worcester Coll.  
 Robertson, Charles, 13, Queen Street.  
 Rigaud, Rev. John, B.D., Fellow of Magdalen College, Oxford.  
 Ryder, Thomas Dudley, M.A., Bowdon, Manchester; Oriel Coll.  
 Rate, Rev. John, M.A., Lapley, Staffordshire.  
 Ralph, Rowland Westby, Littleshall, Shropshire; Lincoln College;

## S.

- Strong, Rev. Augustus, M.A., Chippenham.  
 Spencer, Robert J., 20, New Inn Hall Street.  
 Swinny, Rev. Henry Hutchinson, M.A., Cuddesdon Vicarage, Wheatley.  
 Stoddart, Rev. G. H., A. M., Queen's College; 1, Church Street, Holywell.  
 Somes, George, Worcester College.  
 Sydenham, Mr., Islip.  
 Sutcliffe, Robert, Idle, near Leeds; Three Cups Hotel.  
 Slatter, Rev. John, M.A., Rose Hill, near Oxford.  
 Shuldham, Rev. Naunton, Magdalen College.  
 Strong, Rev. Charles, Dawlish.  
 Sadler, Charles James, Oxford.  
 Scott, Rev. Robert, D.D., Master of Balliol College.  
 Sewell, Robert Burleigh, Radley; New College.

- Slatter, Henry, 3, High Street.  
 Spiers, E. T., 96, High Street.  
 Smith, Rev. G. N., Gumfreston Rectory, Tenby; Trinity College.  
 Scott, Walter F., Balliol College.  
 Salting, William Leverin, Silverlands Park, Chertsey; Queen's College.  
 Spencer, Thomas, Esq., 192, Euston Road, London.  
 Sedgefield, Walter J., Abingdon.  
 Sanders, Henry, Sowton Rectory, Exeter; G. Hussey's, Esq., St. Aldate's.  
 Sandford, Rev. Charles Waldegrave, M. A., Student of Ch. Ch.  
 Simons, William, Renfrew, near Glasgow; No. 6, Roebuck Hotel.  
 Salvin, Osbert, M.A. Camb., F.Z.S., 11, Hanover Terrace, Regents' Park, London; Lincoln College.  
 Da Silva, L. C., Burntwood, Wandsworth Common; Mitre Hotel.  
 Sharp, John, Queen's College, Oxford.  
 Sealy, Alfred Forbes, M.A., Caius College, Cambridge.  
 Strong, Capt. H., Oxford.  
 Shirley, Walter W., 75, Park Street, Oxford.  
 Saunders, Rev. G. E., M.A., Maperton Rectory, Somersetshire; 1, Park Villas, Oxford.  
 Shand, Thomas Henry Rodie, M.A., Brasenose College, Oxford.  
 Snow, W. Parker, Home Cottage, St. John's Hill, Wandsworth, London; Three Cups Inn.  
 Symons, Rev. B. P., D.D., Warden of Wadham College.  
 Simpson, Wilfrid Hudleston, 21, Gloster Place, Portman Square, London, W.; Corpus Christi College.  
 Standen, Richard S., Park Place, St. Giles'.  
 Spiers, Samuel Patey, 14, St. Giles' Street.  
 Sheffield, The Earl of, 20, Portland Place, London; Cuddesden.  
 Sotheby, Lt.-Colonel, C.B., 3, Portugal Street, Grosvenor Square, London; University College.  
 Sykes, John, 11, Upper Seymour Street, Portman Square, London; Exeter College.  
 Smith, Heywood, Ch. Ch., Oxford.  
 Senior, Nassau W., Master in Chancery, Kensington, London; Pembroke College.  
 Strange, Robert, M.D., Naples; Magdalen College.  
 Scarth, Harry Mengden, M.A., Rector of Bathwick, Bath; New College.  
 Sturrock, Peter, Kilmarnock, N. B.

## T.

- Thompson, William, High Street.  
 Thomas, Robert, 52, Holywell Street.  
 Taylor, John, Oxford.  
 Taylor, John, Paradise House, Oxford.

- Trench, Richard, B.A., Museum of Practical Geology, Jermyn Street, London; Islip, Oxon.  
 Tisdall, Thomas, Clontarf, near Dublin.  
 Thomson, William, D.D., Provost of Queen's College.  
 Treacher, Rev. J. S., M.A., Oxford.  
 Taylor, Thomas, Stamp Office, Oxford.  
 Thorp, William, 92, Holywell Street.  
 Turner, Rev. Edward Tindal, M.A., Brasenose College.  
 Taylor, Herbert, M.D., Old Bank, Oxford.  
 Turrell, Henry Joseph, M.A., 96, Holywell Street, Oxford.  
 Thompson, J., Old Bank, Oxford.  
 Taylor, Rev. Alexander, Paddington, London; Queen's College.  
 Thornton, Falkland James, Trinity College, Cambridge; 37, Holywell Street.  
 Tozer, Rev. Henry F., M.A., Exeter College, Oxford.  
 Taylor, Domville, Windham Club, London; St. John's College.  
 Trench, Rev. Francis, Rectory, Islip, Oxfordshire.  
 Tweed, Rev. James, M.A., Rayne, Essex.  
 Tweed, Rev. James Peers, M.A., Fellow of Exeter College, Oxford.  
 Thorley, George Earlam, M.A., Fellow of Wadham College.  
 Townsend, C. C., Trinity College, Cambridge; 9, St. John's Street.  
 Tyler, Charles, F.M.S., 24, Holloway Place, Holloway, London; Pembroke College.  
 Tweed, Rev. Henry Earle, M.A., Oriel College.  
 Twistleton, Hon. Edward, London; Cowley Lodge.  
 Tyrwhitt, Rev. Richard St. John, Ch. Ch.  
 Towle, Alderman John, Hincksey Mill.  
 Tuckwell, Rev. W., Oxford.

## U.

- Undershell, William Wootten, Headington House, Oxon.  
 Underhill, William M., 26, Beaumont Street.

## V.

- Venables, Addington, St. Paul's, Oxford.  
 Vidal, Owen A., Trinity College.  
 Vincent, Cyril John, Surgeon, Oxford.

## W.

- Ward, William, Oxford.  
 Wenthworth, Rev. Stephen E., Riply in Wrea; Balliol College.  
 Worthington, William.  
 Wolston, Rev. Christopher, Newton Abbot; Exeter College.  
 Wellford, John Francis, 9, Park Terrace.  
 Walsh, John, Solicitor, Beaumont Street.  
 Warne, Joseph, Oxford.  
 Wilson, Rev. John, D.D., Trinity College.

- Wilks, Theodore Chambers, M.A., Hook, near Winchfield; Richmond Lodge.
- Wynter, Rev. Phillip, D.D., President of St. John's College.
- Wilson, Rev. H. B., B.D., St. John's College.
- Warburton, Rev. Dr., Iffley Rectory, Oxford.
- Ward, George, Park Villas.
- Wood, Henry, Littlegate.
- West, W. J., 17, St. John's Street.
- Wall, Henry, M.A., Professor of Logic, 24, New Inn Hall Street.
- Walsh, William, 41, Queen Street.
- Wyatt, George Robert, Lic. R.C.P.E., M.R.C.S.L., Oxford.
- Woollaston, Thomas Samuel, St. Peter's College, Cambridge; 41, St. Giles' Street.
- Wyatt, James, 115, High Street.
- Wyatt, George, Newport, Isle of Wight; 115, High Street.
- Ward, Rev. G. S., M.A., Magdalen Hall.
- West, Robert Uvedale, M.D., Alford, Lincolnshire; Lincoln Coll.
- Westerman, Richard, Leeds; Ship Inn, Ship Street.
- Whiteaves, J. F., F.G.S., 62, St. John's Street.
- Walsh, William Henry, Oxford.
- Wright, Dr. Thomas, Cheltenham.
- Wrottesley, The Hon. Arthur, Wrottesley Hall, Wolverhampton.
- Wrottesley, The Hon. George, Wrottesley Hall, Wolverhampton.
- Wrottesley, Hon. E. B., White Lodge, Putney, S.W.
- Walton, Rev. H. Baskerville, M.A., Merton College.
- Waddingham, Thomas James, Guiting Grange; Mitre Hotel.
- Waddingham, John, Jun., Guiting Grange, Winchcomb; Mitre Hotel.
- Woolner, Thomas, 27, Rutland Street, London; Clarendon Press.
- Wall, John Blenman, 24, New Inn Hall Street.
- Wickham, Rev. E. C., M.A. New College.
- Wylie, A. H., Edinburgh; Magdalen College.
- Ward, Thomas, Solicitor, Oxford.
- Watkins, George, 4, Blenheim Place.
- Wilton, Rev. Edward, Doncaster, Yorkshire; Queen's College.
- Wiltshire, Rev. Thomas, M.A., F.G.S., &c., Rectory, Bread Street Hill, London.
- Wyatt, C. Francis, Forest Hill, Wheatley, Oxon.
- Williams, Rev. Charles, D.D., Principal of Jesus College.
- Ward, Rev. Henry, A.M., Aldwinckle, Northamptonshire; Mitre Hotel.
- Ward, Henry, 12, Beaumont Street.
- Worden, John, Walthamstow, Essex; 18, Ship Street.
- Watson, Rev. Albert, M.A., Fellow of Brasenose College.
- Watson, Jonas, Fairwater, near Cardiff; Oriel College.
- Walker, Captain W., Staff College, Farnborough, Hants; Wadham College.

- Wordsworth, Rev. Canon, D.D., Cloisters, Westminster Abbey;  
The Rev. the Warden's, All Souls' College.  
Westminster, The Dean of, Deanery, Westminster; Oxford.  
Welch, Christopher, 24, Lower Belgrave Street, London; Wadham  
College.  
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King's Arms, Oxford.  
West, Rev. Washbourne, B.D., Lincoln College.  
Wilgress, Rev. G. F., Garsington.  
Whitney, Henry, Iffley.  
Wrotesley, Captain, All Souls' College.  
Wyndham, Hon. Percy, Petworth, Sussex; Cuddesdon.  
Wilkinson, William, 5, Beaumont Street.  
Wingfield, Rev. Charles Lee, M.A., All Souls' College.  
Wood, Edward, F.G.S., Richmond, Yorkshire; Mitre Hotel.  
Ward, Josiah O., New York City, U. S.; King's Arms' Hotel.  
Woolcombe, Rev. Edward C., M.A., Balliol College.  
Woodford, W., St. John's Terrace.  
White, Charles, Barnesfield, near Dartford, Kent; Magdalen Coll.  
Wakefield, Edward Thomas, B.A., Lincoln's Inn, London.

## Y.

- Yonge, W. J., Rockbourne.  
Yates, Rev. William, M.A., Brasenose College.

OXFORD 1860.

# BRITISH ASSOCIATION.

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## SUPPLEMENTARY LIST

OF

## MEMBERS AND ASSOCIATES,

*Registered to Saturday, June 30, 1860.*

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Sheffield Literary and Philo- sophical Society	.. .. .	{ Rev. S. Earnshaw, M.A.
Manchester Photographic Society.	..	Samuel Cottam, Esq.

---

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Siemens, Werner, Berlin.  
Macgowan, D. T., M.D., New York.  
Dullo, Dr., Königsberg, Prussia.  
Zumpt, Professor Dr., Berlin.  
Shaffner, Colonel Tal. P., Kentucky, United States.  
Train, George Francis, Boston, United States.  
Pierce, B., Perkins Professor of Astronomy and Mathematics, Cambridge,  
United States.

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London; Professor Brodie's.  
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Barrett, G. B., Welshpool; 12, Market Street.  
Brebner, Alexander C., Albyn Place, Aberdeen; Beckly Grove.  
Bowman; William, F.R.S., Clifford Street, London.  
  
Carter, Richard, C. E., Long Carr, Barnsley; Roebuck Hotel.  
  
Dunraven, the Earl of, F.R.S., F.R.A.S., Adare Manor, co. Limerick and  
Dunraven Castle, Glamorganshire; Ch. Ch.

- Dawes, John S., F.G.S., Smethwick House, Birmingham; Mitre Hotel.  
 Dickinson, Joseph, M.D., F.R.S., Liverpool.  
 Durham, Arthur E., F.R.C.S., F.L.S., F.Z.S., Demonstrator of Anatomy,  
 Guy's Hospital; Queen's College.  
 Downing, S., LL.D., Professor of Civil Engineering in the University of  
 Dublin; Oriel College.
- Erle, Rev. Christopher, M.A., F.G.S., Hardwick, Buckinghamshire; New  
 College.
- Gotch, Rev. Dr. F. W., Bristol; 94, High Street.  
 Graves, Rev. Charles, M.A., Professor of Mathematics in the University  
 of Dublin; Balliol College.  
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 Harris, Alfred, Ryshworth Hall, Bingley, Yorkshire; 102, High Street.  
 Heron, Joseph, Manchester; Angel Hotel.  
 Hector, James, M.D., Northumberland St., Edinburgh; 22, Cornmarket  
 Street.
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 Kirkman, Rev. T. P., M.A., F.R.S., Croft Rectory, near Warrington; Bal-  
 liol College.
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- Moore, J. Carrick, M.A., F.R.S., F.G.S., Cornwall, Wigtownshire.  
 Mylne, Robert W., F.R.S., F.G.S., London; Ch. Ch.  
 Maskelyne, Nevil Story, B.A., British Museum, London; Wadham Coll.  
 McConnel, J. E., Wolverton Park, Buckinghamshire; Star Hotel.  
 Marling, Samuel S., Stanley Park, Stroud, Gloucestershire; 131, High St.  
 Matthews, William, jun., B.A., F.G.S., Edgbaston, Birmingham; Maiden-  
 head Hotel.
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 Place, St. Giles'.  
 Neilson, Walter, Summerlee, Glasgow.
- Playfair, Lyon, C.B., Ph.D., F.R.S., F.C.S., Professor of Chemistry in  
 the University of Edinburgh; Mitre Hotel.
- Pochin, Henry Davis, Quay Street, Salford; 3, Wellington Place, St. Giles'.  
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3, Wellington Place, St. Giles'.

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Story, James, Bryanston Square, London.

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Webster, J., Sheffield.  
Walker, Charles V., F.R.S., Red Hill, near Reigate.  
Whiteside, Rt. Hon. James, M.P., M.R.I.A., Mountjoy Sq., Dublin.

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Prince Frederick of Schleswig-Holstein, London; Wadham College.  
Atkinson, T. W., Hawk Cottage, Old Brompton, London; Balliol College.  
Allardyce, Major-General, Cromarty; Star Hotel.  
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Bevers, Edmund, 46, Broad Street.  
Butler, George, M.A., Cheltenham; Exeter College.  
Brown-Sequard, Dr., F.R.S., F.R.C.P., 81 Wimpole Street, London.  
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Fergusson, James, 20, Langham Place, London ; Wadham College.

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Hawkins, William, Hitchin, Herts ; Exeter College.

Harvey, Henry Newton, Southampton ; C. C. C.

Heathcote, Sir William, Bart., M.P., D.C.L., Hursley Park, Winchester ;  
All Souls College.

Hayman, Henry, B.D., Cheltenham ; St. John's College (late Fellow).

Henney, Rev. T. F., Pembroke College.

Harris, Charles E., 3, Lansdowne Place, Blackheath ; 102, High St.

Jenkins, Rev. I. D., B.D., Jesus College.

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McLaughlin, Rev. Hubert, Boraston Rectory, Tenbury ; Roebuck Hotel.

Menzies, J. H., Liverpool ; Brasenose College.

Menzies, Henry, Liverpool ; Brasenose College.

McNab, D. B., M.R.C.S.L., Epping, Essex ; Angel Hotel.

Norwood, Rev. T. W., F.G.S., Park Place, Cheltenham.

Ogle, Dr. John, 13, Upper Brook Street, London ; Trinity College.

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Palliser, J., Comragh, Kilmarthomas, Ireland ; Castle's, Corn Market.

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Russell, Arthur, M.P., Audley Square, London ; Wadham College.

Skinner, J., Clifton ; 57, St. Giles'.

Stuart, Rev. H. C., Stow-on-the-Wold.

Smith, O., Bryanston Square, London ; Trinity College.

Temple, Rev. Frederick, D.D., Headmaster of Rugby School ; Balliol Coll.

Vaux, W. S. W., (Balliol College,) British Museum ; Star Hotel.

Waterfield, T., M.D., London ; Trinity College.

OXFORD 1860.

BRITISH ASSOCIATION.

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SECOND

SUPPLEMENTARY LIST

OF

MEMBERS AND ASSOCIATES,

*Registered to Monday, 9 P. M., July 2, 1860.*

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*Deputation from the Town Council of the Borough  
of Salford.*

The Mayor.  
Mr. Alderman Langworthy.  
Mr. Councillor Pochin.  
Mr. Councillor Corner.  
Mr. Brett, Town Clerk.

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FOREIGNERS.

Anca of Mangalairti, The Baron Francesco, Palermo, Sicily.  
Futsch, Anton, M.D., Prague.  
Ollier, Leopold, M.D., Lyons.

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MEMBERS.

Acland, Thomas Dyke, Sprydoncote, Exeter ; Dr. Acland's, Broad Street.  
Arnott, Neil, M.D., F.R.S., Cumberland Terrace, London ; 54, St. John  
Street.  
Atkinson, Joseph B., Cotham, Bristol ; Star Hotel.  
Beale, Samuel, Birmingham.  
Brett, George, Town Clerk, Salford ; Angel Hotel.  
Calvert, Professor F. Crace, F.C.S., Royal Institution, Manchester.  
Chadwick, David, Salford ; 3, Wellington Place.  
Chambers, Dr. T. R., Hill Street, London ; Dr. Acland's, Broad Street.  
Corner, Charles Tinsley, New Brown Street, Manchester ; Angel Hotel.  
Cotton, William, F.R.S., F.S.A., Crosby Square, London.

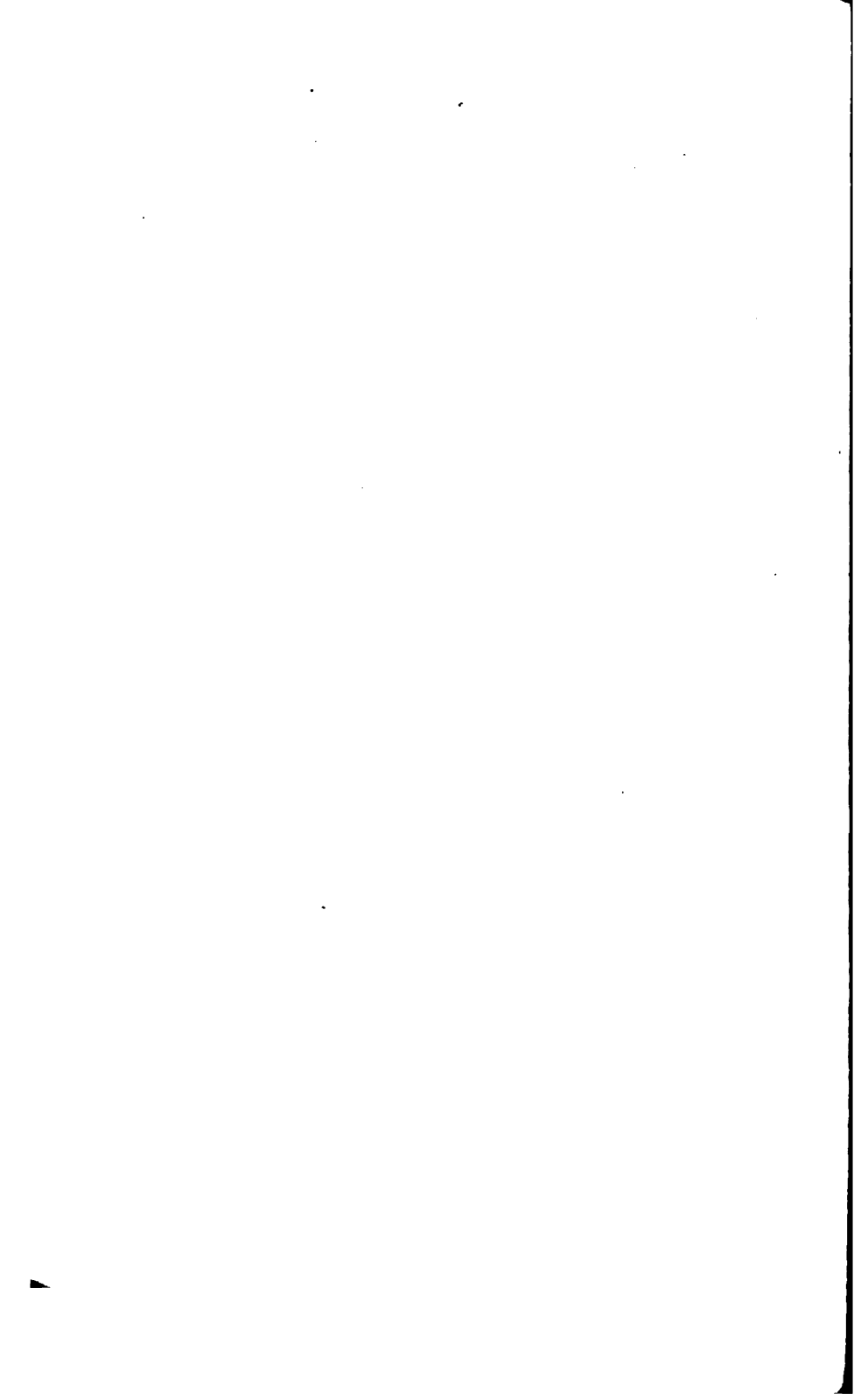
- Dancer, John B., F.R.A.S., Manchester ; 37, Holywell Street.
- Edwards, J. B., Ph.D., Liverpool.
- Francis, William, Ph. D., F.L.S., F.G.S., Red Lion Court, Fleet Street, London ; Balliol College.
- Glennie, J. S. Stuart, F.R.G.S., Stone Buildings, Lincoln's Inn, London ; Star Hotel.
- Heywood, James, F.R.S., Palace Gardens, Kensington, London.
- Hodgson, Joseph, F.R.S., Westbourne Terrace, London.
- James, Colonel Sir Henry, R.E., F.R.S., Director of the Ordnance Survey, Southampton ; Magdalen College.
- King, Mervyn Kersteman, Rodney Place, Clifton ; 73, St. Aldate's Street.
- Martin, Studley, Liverpool.
- Mackie, Ivie (Mayor of Manchester,) Manchester ; Angel Hotel.
- Phillips, Major-General Sir Travell, F.R.G.S., London ; Mitre Hotel.
- Roscoe, Dr. Henry E., Owens College, Manchester ; Ch. Ch.
- St. Leger, Antony F. B., Berkeley Square, London.
- Sharp, Rev. John, M.A., Horbury, Wakefield ; Beckley Grove.
- Thorpe, The Venerable Thomas, D.D., Archdeacon of Bristol, F.G.S., Kemerton, near Tewkesbury ; 15, Merton Street.
- Weston, J. W., (Mayor of Salford,) St. Ann's Street, Manchester ; Angel Hotel.
- Wilson, Rev. Sumner, Horton Heath, Bishopstoke, Southampton ; Ch. Ch.
- Yates, James, M.A., F.R.S., F.L.S., F.G.S., Lauderdale House, Highgate, London ; Star Hotel.

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## ASSOCIATES.

- Acland, Rev. P. L. D., Broad Clyst, Exeter ; Dr. Acland's.
- Branson, Rev. George, M.A., Marlborough College, Wilts ; Magdalen College.
- Brodrick, George, M.A., Fellow of Merton College, Oxford, and University Law Scholar, Univ. of London, 32 A, Mount Street, London ; Merton College.
- Brand, Thomas, East Lutton, near Malton, Yorkshire ; Railway Hotel.
- Clegram, William Brown, C.E., Gloucester ; Star Hotel.

- Duggan, Professor Paul P., New York, United States.
- Ellis, John Walton, Thornthwaite, near Ripley, Yorkshire.
- Fisher, J. C., Wood Hall, Cockermouth ; Queen's College.
- Hunter, Dr. Thomas, Deputy Inspector-General Army, London ; 4, Oriol Street.
- Healey, George W., Boston, United States, America ; Angel Hotel.
- Kell, Rev. Edmund, M. A., F. S. A., Portswood Lawn, Southampton ; H. Hatch, Esq., Crescent Villa, Oxford.
- Labuan, The Bishop of, Borneo, and Queen's Terrace, London ; Ch. Ch. Lange, Daniel Adolphus, 21, Regent Street, Waterloo Place, London ; Mitre Hotel.
- Millar, Lieut. J. A., Royal Engineers, Portsmouth ; 138, High Street.
- Moberly, Rev. George Herbert, B. A., Corpus Christi College.
- MacDonnell, John, R. G. S., Grove End Road, St. John's Wood, London ; Roebuck Hotel.
- M'Donnell, Alexander, Hereford ; Pembroke College.
- Middleton, Rev. J. D., M. A., Paddington, London ; 33, High Street.
- Oppenheim, Alphonse, Ph. D., London ; Roebuck Hotel.
- Prevost, Alexander Peter, Doctor of Science, London.
- Pollak, S., M. D., St. Louis, United States ; Star Hotel.
- Quekett, John, F. R. S., F. L. S., Conservator of the Hunterian Museum, Professor of Histology, Royal College of Surgeons, London, and President of the Microscopical Society ; Royal College of Surgeons, London ; Dr. Acland's.
- Ringer, Theobald, M. D., Lahore Light Horse ; Dr. Newman, Magd. Coll.
- Rowell, —, 23, High Street.
- Richardson, B. W., M. A., M. D., 12, Hinde Street W., London.
- Sewell, Rev. J. E., D. D., Warden of New College.
- Smyth, Warrington, M. A. (Camb.), F. R. S., F. G. S., Jermyn St., London.
- Sowdon, Arthur J. C., Boston, United States ; Angel Hotel.
- Tomes, Charles S., Radley.
- Thudichum, John Louis William, M. D., Member of the Royal College of Physicians, London.
- Weir, John, Liverpool ; Grace's Hotel.



BRITISH ASSOCIATION  
FOR  
THE ADVANCEMENT OF SCIENCE,

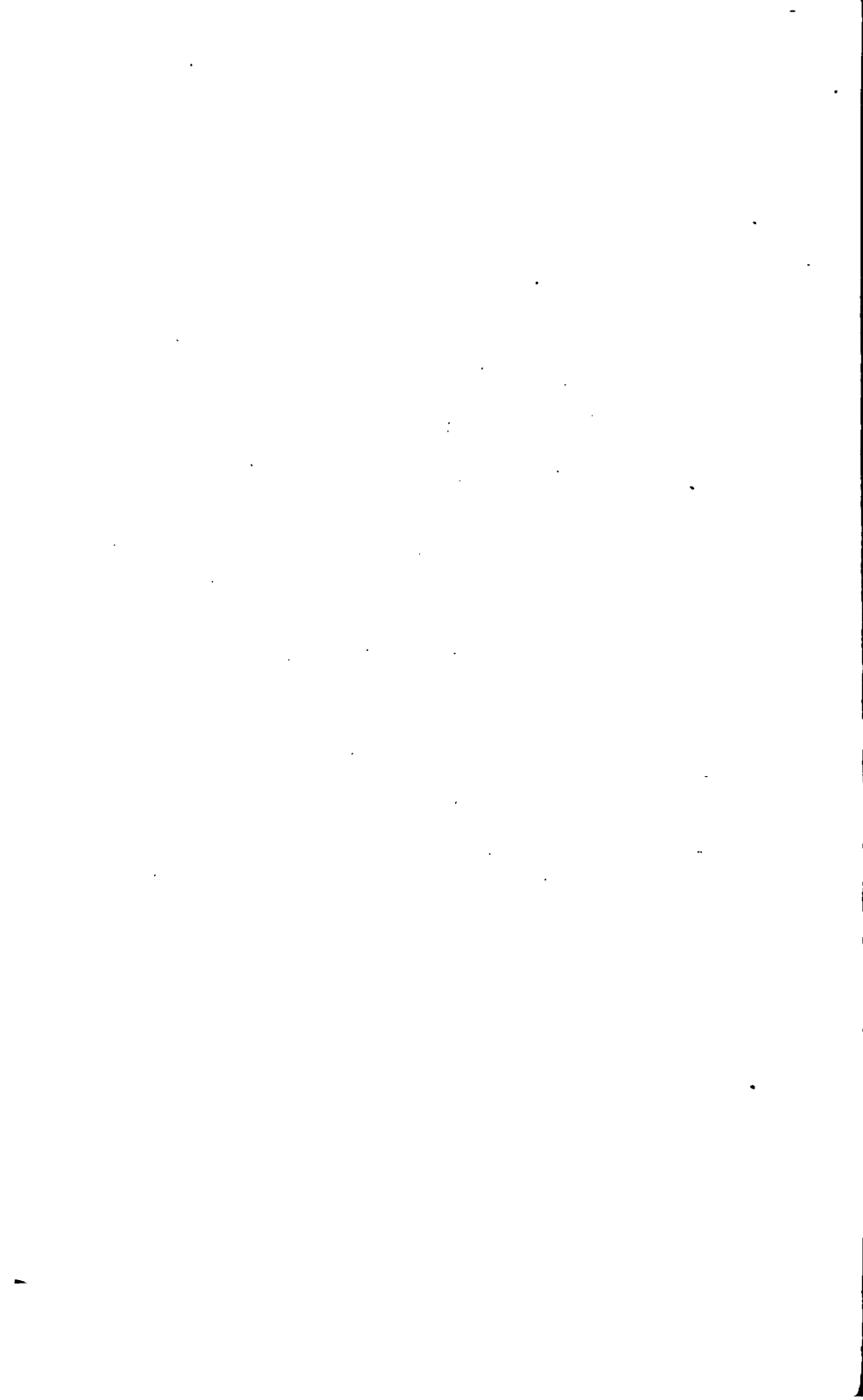
OXFORD, JUNE 1860.

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A D D R E S S

BY

The Right Honourable the Lord Alton of Liverpool,  
PRESIDENT.



## ADDRESS

BY

THE RIGHT HON. THE LORD WROTTESLEY.

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GENTLEMEN,—If, on taking this Chair for the first time as your President, I do not enlarge upon my deficiencies for adequately filling the responsible office to which you have done me the honour to elect me, I hope you will believe that I am not the less sensible of them.

Your last Meeting was held under the Presidency of one not more distinguished by his high rank and exalted station than by his many excellent qualities, and the discriminating interest which he has ever manifested in the promotion of Art and Science. It was one of the most successful Meetings on record.

We are now once more assembled in this ancient and venerable seat of learning; and the first topic of interest which presents itself to me, who owe to Oxford what academic training I have received, is the contrast presented by the state of Science and the teaching of Science in this University in the Autumn of the year 1814, when my residence here commenced, and for five years afterwards, with its present condition. As the private pupil of the late Dr. Kidd, and within a few yards of the spot from which I have now the honour to inaugurate the Meeting of this distinguished Association, I first imbibed that love of Science from which some of the purest pleasures of my life have been derived; and I cannot mention the name of my former Tutor without acknowledging the deep debt of gratitude I owe to the memory of that able, conscientious and single-hearted man.

It was at this period that a small knot of Geologists, headed by Broderip, Buckland, the two Conybeares and Kidd, had begun to stimulate the curiosity of the Students and resident Graduates by Lectures and Geological excursions in the neighbourhood of this town. The lively illustrations of Buckland, combined with genuine talent, by degrees attracted crowds to his teaching, and the foundations of that interesting science, already advancing under the illustrious Cuvier in France, and destined soon to spread over Europe, were at this time fairly laid in England within these classical Halls. Many a time in those days have my studies been agreeably interrupted by the



cheerful laugh which invariably accompanied the quaint and witty terms in which Buckland usually announced to his brother Geologist some new discovery, or illustrated the facts and principles of his favourite science. At the time, however, to which I refer, the study of physical science was chiefly confined to a somewhat scanty attendance on the Chemical Lectures of Dr. Kidd, and on those on Experimental Philosophy by Rigaud; and in pure mathematics the fluxional notation still kept its ground. In the year 1818 Vince's Astronomy, and in the following year the Differential Notation, was first introduced in the mathematical examinations for honours. At that time that fine foundation the Radcliffe Observatory was wholly inactive; the observer was in declining health, and the establishment was neither useful to astronomical students, nor did it contribute in any way to the advancement of Astronomical Science. Even from the commencement of the present century, and in proportion as the standard of acquirement in classical learning was gradually raised by the emulation excited by the examinations for honours, the attendance on the above-mentioned Lectures gradually declined: but a similar cause enhanced the acquirements of students in pure and applied Mathematics, and the University began to number among its Graduates and Professors men of great eminence in those departments of knowledge. Nor were the other sciences neglected; and as Chairs became vacant or new Professorships were established, men of European reputation were appointed to fill them. In proof of all this I need only direct attention to the names on the roll of Secretaries, Vice-Presidents and Presidents of Sections, to convince you that Oxford now contains among her resident Graduates, men amply qualified to establish and advance the scientific fame of that University, of which they are the distinguished ornaments.

On the progress of Astronomy I will, as becomes me, enter into more detail. And it is not without pain that I allude to this subject, because I am reminded that one has been removed from among us by the hand of death, whom I had looked forward to meeting again on this occasion with peculiar pleasure. I never knew any one who had the interests of science more truly at heart, or laboured more diligently to advance them, than the late Radcliffe Observer, Mr. Manuel Johnson. By his exertions and indefatigable zeal the Radcliffe Observatory was enabled to take its proper place among the Scientific Institutions of the world. By the liberality of the Trustees and by the exertion of his influence, new instruments were purchased, and an extensive series of valuable astronomical observations was made; and, what is quite as important, they were regularly reduced and published. In addition to all this, a noble array of self-recording meteorological instruments was brought into action, and their records duly reduced and co-ordinated. I was myself a candidate in 1839 for that office to which Mr. Johnson was then appointed, and I have often rejoiced that I was not successful, as it would have retarded for a time the promotion of one, to whom Astronomy owes a deep debt of gratitude. Mr. Johnson was suddenly taken from us at a time

when he was in the full career of his useful labours, and there are few labourers in science whose loss has been more deplored. The University has very lately lost another learned Professor, and myself another valued friend, whose contributions to science are well known and duly esteemed. The great tragic Poet of Greece introduces his hero accusing his heathen gods of rescuing from the grave the vile and worthless, and sending thither the good and useful:—

..... τὰ δὲ δίκαια καὶ τὰ χρηστὰ  
ἀποστέλλουσιν δαί.

Our purer faith in meek resignation trusts that they are removed from evil to come, and that there at least they rest from their labours—rest from earthly toil and trouble, but awake, may be, to higher aims and aspirations, and with nobler faculties and duties.

Although a successor may be appointed to Mr. Johnson, who will, I doubt not, admirably discharge the duties of Radcliffe Observer, I fear that the Observatory may not continue to maintain its high reputation, unless a sufficient staff of Assistants be appointed to aid the Observer in his labours. There is no mistake more fatal in Astronomy than that of multiplying instrumental means without providing an adequate supply of hands to employ them.

I have already alluded to some particulars in which this great University has advanced in the career of scientific improvement, but everything else has been somewhat thrown into the shade by the important event of this year, the opening of the new Museum. The University could have given no more substantial proof of a sincere interest in the diffusion of science than the foundation of this noble Institution, and I am sure that among the distinguished cultivators of science here assembled, there is not one who does not entertain a hearty desire for the success of the various efforts now in progress for the purpose of stimulating our University Students to a closer contemplation and more diligent study of the glorious works of Nature; a study, which, if prosecuted earnestly, raises us in the scale of human beings and improves every moral and intellectual faculty. Towards the attainment of a result so much to be desired the Museum will most powerfully contribute, and those who frequent it will owe deep obligations to Mr. Hope and the other benefactors who have generously added to its stores. But there are other causes in operation which tend to the same end; and among them, in addition to such improvements as arise out of the changes consequent on the recent Act of Parliament, may be mentioned the alteration in the distribution of University Honours.

The institution of the School of Physical Science forms a most important feature in the recent changes, and will doubtless be productive of good results, provided that sufficient encouragement by way of reward be held out to those whose tastes lead them to devote themselves to those departments of knowledge, and that the compulsory arrangements in respect of other studies

allow sufficient time to the student to accomplish his object. The great majority of physical students must necessarily belong to that class who have their subsistence to earn; and however earnest may be their zeal for mental improvement, there will be few candidates for the honours of the Physical School unless due encouragement be given to excellence in that department. It was therefore with sincere pleasure that I learnt that three Fellowships had been founded at Magdalen College as prizes for proficiency in Natural Science; and that at the same College, and at Christ Church and Queen's, Scholarships and Exhibitions had been provided for students who evince during their examinations the greatest aptitude for such studies. Moreover, the acquisition of a Radcliffe travelling Fellowship has been made to depend upon obtaining distinction in the School of Natural Science. In addition to all this, that beneficent and enlightened lady, Miss Burdett Coutts, has founded two Scholarships with the view of extending among the Clergy educated at the University a knowledge of Geology. Great hopes are justly excited in the minds of all well-wishers to the University by these events, and by reflection on the great change of opinion which must have taken place since the period when Dr. Kidd, with the aid of Dr. Daubeny, Mr. Greswell and others, in vain attempted to raise a small sum by private subscription for building a modest receptacle for the various collections of Natural History. How little could these public-spirited individuals have foreseen, that within a few short years a sum approaching to £100,000 would be appropriated to the building and furnishing that splendid monument of Oxford's good will to science, the New Museum!

It would not be right, however, if, while speaking in just and sincere terms of praise of all that excites my admiration in the late proceedings at Oxford, I were to withhold the honest expression of my opinion on points on which I feel compelled to differ from the course pursued. I will therefore refer to two measures, one of which especially I cannot but regard as a mistake. The first is the repeal of the statute which enforced attendance on two courses of Professorial lectures; a requirement, which may have had no small influence in creating a taste for natural science among that large class of students, whose only object it is to obtain, in a creditable manner if possible, but at all events to obtain, the distinction of an Academical degree. At the same time I cannot but be sensible that the amount of instruction imparted in this way, even if the attendance were much more than nominal, must necessarily have been small, not from any want of competency in the teachers, but from the inherent defect of the system of lectures unaccompanied by examinations, and on this account I the less regret the change.

The second, and more serious mistake, in my humble opinion, is the rejection by the Congregation in 1857 of the proposal of the Hebdomadal Council, that the Undergraduate, after passing his first two classical examinations, should be permitted to select his own line of study, and submit himself at his option to a final examination in any one of the four Schools,

that is, the Classical, the Mathematical, History and Law, or Natural Science. The Hebdomadal Council were I think right in believing that such mental discipline as classical study can impart—and far be it from me to undervalue it in the least—would be sufficiently secured by the classical requirements of the two first examinations; and that the study of Mathematics and the Natural Sciences, besides imparting much valuable information, which might be extensively utilized in after-life, might equally be viewed as an important means of improving the intellectual faculties. There is another consideration which must not be lost sight of in deciding on the policy of the course then pursued. I think that it cannot in fairness be expected that a young man of the average abilities of those who contend for honours, and who is called upon to pass two classical examinations, and prepare for a third, before he is allowed to follow the bent of his genius and apply himself to his favourite study, can find time to attain a sufficient proficiency in it to pass a really creditable examination; accordingly the necessary result will be that the Examiners will be obliged to lower the standard of honour, the rather that most of the students now come to the University without having acquired even the elements of scientific knowledge, and thus the first class may almost cease to be a distinction worth attainment.

I cannot take leave of recent University changes without adverting to that great, that noble step, the institution of the Middle Class Examinations, whereby Oxford has furnished substantial aid to those more humble aspirants to knowledge, by whom a University education, however much desired, is quite unattainable. Whether this movement be viewed in its moral effect, as showing a kindly sympathy of the higher intellectual class with the struggling but deserving children of a lower sphere, or as the best expedient for bringing about a complete reform in our educational establishments, and therefore a great engine for advancing popular education—whether this grand and liberal step be viewed in one or both these aspects, it has given the most unmixed and heartfelt satisfaction to all who have the moral and mental improvement of the nation sincerely at heart; and greatly do I rejoice that such a satisfactory proof should have been given of a desire to make University Institutions a general national blessing.

Oxford, then, has shown herself fully equal to her glorious mission, and it was only a fitting sequel to such enlightened conduct, that she should be entrusted with the grateful task of educating the Heir apparent to the Throne of the most popular Sovereign who ever swayed the sceptre of this vast Empire.

I shall perhaps be forgiven if my former connexion with Oxford, and the interest which I must ever take in everything appertaining to my own University, have induced me to dwell somewhat at length on the above matters. It is now time that I should direct my attention to the general domain of science; but more particularly to that department to which my own labours, humble though they be, have been more especially devoted,—I mean the

science of Astronomy, a science, which, whether we consider the surpassing interest of the subjects with which it is conversant, or the lofty nature of the speculations to which its inquiries lead, must ever occupy a most distinguished, if not the first place among all others.

In a discourse addressed in May 1859 to the Imperial Academy of Sciences of Vienna, by the distinguished Astronomer Littrow, a very full account is given of the voluntary contributions of the private observers of all nations to the extension of the science of Astronomy; and this discourse concludes with a remarkable sentence, of which our English Amateurs may well be proud: he expresses a hope that on the next occasion in which he shall be called upon to dilate on the same theme, he shall not as then have to mention English names in such preponderating numbers.

At the beginning of the year 1820, when the Astronomical Society was founded, the private Observatories in this country were very few in number. The establishment of that Society gave a most remarkable stimulus to the cultivation of the science which it was intended to promote. I can give no better proof of this than the fact that the Nautical Almanac now contains a list of no less than twelve private Observatories in the United Kingdom, at nearly all of which some good work has been done; and in addition to this, some Observatories, which have been since discontinued, have performed most important services—I may instance that of the two Herschels at Slough, and that of Admiral Smyth at Bedford.

It may not be uninteresting if I describe the nature and utility of some of the results which these several establishments have furnished to the world: I say the *world* advisedly, for scientific facts are the common inheritance of all mankind.

But first a word as to the peculiar province of the observatories which are properly called "public," such as the far-famed Institution at Greenwich. Their task is now more peculiarly to establish with the last degree of accuracy the places of the principal heavenly bodies of our own system, and of the brighter or fundamental fixed stars, which are about 100 in number. But in the early stages of Astronomy, we were necessarily indebted to public Observatories for all the data of the science. On the other hand, their voluntary rivals occupy that portion of the great astronomical field which is untilled by the professional observer; roving over it according to their own free will and pleasure, and cultivating with industrious hand such plants as the more continuous and severe labours of the public Astronomer leave no time or opportunity to bring to maturity.

The observations of our private observers have been chiefly devoted to seven important objects:—

First. The observing and mapping of the smaller stars, under which term I include all those which do not form the peculiar province of the public observer.

Secondly. The observations of the positions and distances of double stars.

Thirdly. Observations, delineations, and Catalogues of the Nebulæ.

Fourthly. Observations of the minor planets.

Fifthly. Cometary observations.

Sixthly. Observations of the solar spots, and other phenomena on the Sun's disc.

Seventhly. Occultations of stars by the Moon, eclipses of the heavenly bodies, and other occasional extra-meridional observations.

And first as to cataloguing and mapping the smaller stars. This means, as you know, the accurate determination by astronomical observation of the places of those objects, as referred to certain assumed fixed points in the heavens. The first Star Catalogue worthy to be so called, is that which goes by the name of Flamsteed's, or the British Catalogue. It contains above 3000 stars, and is the produce of the labours of the first Astronomer Royal of Greenwich, labours prosecuted under circumstances of great difficulty, and the results of which were not given to the world in a complete form till many years had elapsed from the time the observations were made, which was during the latter half of the seventeenth century. About the middle of the eighteenth century, the celebrated Dr. Bradley, who also filled the post of Astronomer Royal, observed an almost equally extensive Catalogue of Stars, and the beginning of the nineteenth century gave birth to that of Piazzi of Palermo. These three are the most celebrated of what may be now termed the ancient Catalogues. About the year 1830 the attention of modern astronomers was more particularly directed to the expediency of re-observing the stars in these three Catalogues, a task which was much facilitated by the publication of a very valuable work of the Astronomical Society, which rendered the calculations of the observations to be made comparatively easy, and accordingly observations were commenced and completed in several public and private Observatories, from which some curious results were deduced, as *e. g.*, sundry stars were found to be missing, and others to have what is called *proper motion*. And now a word as to the utility of this course of observation. It is well observed by Sir John Herschel, "that the stars are the landmarks of the Universe; every well-determined star is a point of departure which can never deceive the astronomer, geographer, navigator, or surveyor." We must have these fixed points in order to refer to them all the observations of the wandering heavenly bodies, the planets and the comets. By these fixed marks we determine the situation of places on the earth's surface, and of ships on the ocean. When the places of the stars have been registered, celestial charts are constructed; and by comparing these with the heavens, we at once discover whether any new body be present in the particular locality under observation: and thus have most of the fifty-seven small or minor planets between Mars and Jupiter been discovered. The observations, however, of these smaller stars, and the registry of their places in Catalogues, and the comparisons of the results obtained at different and distant periods, have revealed another extraordinary

fact, no less than that our own Sun is not fixed in space, but that it is constantly moving forward towards a point in the constellation Hercules, at the rate, as it is supposed, of about 18,000 miles an hour, carrying with it the whole planetary and cometary system; and if our Sun moves, probably all the other stars or suns move also, and the whole universe is in a perpetual state of motion through space.

The second subject to which the attention of private observers has been more particularly directed, is that of double or multiple stars, or those which, being situated very close to one another, appear single to the naked eye, but when viewed through powerful telescopes are seen to consist of two or more stars. The measuring the angles and distances from one another of the two or more component stars of these systems, has led to the discovery that many of these very close stars are in fact acting as suns to one another, and revolving round their common centre of gravity, each of them probably carrying with it a whole system of planets and comets, and perhaps each carried forward through space like our own sun. It became then a point of great interest to determine, whether bodies so far removed from us as these systems, observed Newton's law of gravity, and to this end it was necessary to observe the angles and distances of a great number of these double stars scattered everywhere through the heavens, for the purpose of obtaining data to compute their orbits. This has been done, and chiefly by private observers; and the result is that these distant bodies are found to be obedient to the same laws that prevail in our own system.

The Nebulæ are, as it were, systems or rings of stars scattered through space at incredible distances from our star system, and perhaps from one another; and there are many of these mysterious clouds of light, and there may be endless invisible regions of space similarly tenanted. Now the nearest fixed star of our star system whose distance has been measured, is the brightest in the constellation Centaur, one of the Southern constellations, and this nearest is yet so far removed, that it takes light, travelling at the rate of about 192,000 miles per second, three years to arrive at the earth from that star. When we gaze at it, therefore, we see it only as it existed three years ago; some great convulsion of nature may have since destroyed it. But there are many bright stars in our own system, whose distance is so much greater than this, as  $\alpha$  Cygni, for example, that astronomers have not succeeded in measuring it. What, then, must be the distance of these nebulæ, with which so much space is filled; every component star in which may be a sun, with its own system of planets and comets revolving round it, each planet inhabited by myriads of inhabitants! What an overpowering view does this give us of the extent of creation! The component stars of these nebulæ are so faint and apparently so close together, that it is necessary to use telescopes of great power, and with apertures so large as to admit a great amount of light, for their observation. We owe it more especially to four individuals, that telescopes have been constructed, at a great cost and with great mechanical skill, suf-

ficiently powerful to penetrate these depths of space. Those four individuals are the Herschels, father and son, Lord Rosse, and Mr. Wm. Lassell. That praiseworthy nobleman, Lord Rosse, began his meritorious career by obtaining a First Class at this University, and has, as you know, spent large sums of money and displayed considerable mechanical genius in erecting, near his own Castle in Ireland, an instrument of far greater power than any other in the world; and with it he has observed these nebulae, and employed skilful artists to delineate their forms: and he has moreover made the very curious discovery, that some of them are arranged in a spiral form, a fact which gives rise to much interesting speculation on the kind of forces by which their parts are held together. It were much to be wished that observations similar to these, and with instruments of nearly the same power, should be made of the Southern nebulae also; that this generation might be able to leave to posterity a record of their present configurations. The distinguished Astronomer, Mr. Wm. Lassell, the discoverer of Neptune's satellite, has just finished at his own cost an instrument equal to the task, mounted equatorially; and I am not without hope that it may, at perhaps no very distant period, be devoted to its accomplishment. A recent communication from him to the Astronomical Society expresses satisfaction with the mounting of his instrument, and after many trials its great speculum has at last come forth nearly perfect from his laboratory.

I am, however, warned by the lapse of time, that it will not be possible for me to exhaust the whole field, the limits of which I have sketched, in which private enterprise has been assiduously at work to enlarge the bounds of astronomical knowledge. I will therefore pass at once to the two most interesting subjects which remain, the observations of Comets, and of peculiar appearances on the Sun's disc.

Of all the phenomena of the heavens, there are none which excite more general interest than comets, those vagrant strangers, the gipsies as they have been termed of our solar system, which often come we know not whence, and at periods when we least expect them: and such is the effect produced by the strangeness and suddenness of their appearance, and the mysterious nature of some of the facts connected with them, that while in ignorant times they excited alarm, they now sometimes seduce men to leave other employments and become Astronomers. Now, though the larger and brighter comets naturally excite most general public interest, and are really valuable to astronomers, as exhibiting appearances which tend to throw light on the internal structure of these bodies, and the nature of the forces which must be in operation to produce the extraordinary phenomena observed, yet some of the smaller telescopic comets are, perhaps, more interesting in a physical point of view. Thus the six periodical comets, the orbits of which have been determined with tolerable accuracy, and which return at stated intervals, are extremely useful as being likely to disclose facts, of which but for them we should possibly have ever remained ignorant. Thus, for example, when the



comet of Encke, which performs its revolution in a period of a little more than three years, was observed at each return, it disclosed the important and unexpected fact, that its motion was continually accelerated. At each successive approach to the Sun it arrives at its perihelion sooner and sooner; and there is no way of accounting for this so satisfactory as that of supposing that the space, in which the planetary and cometary motions are performed, is everywhere pervaded by a very rarefied atmosphere or ether, so thin as to exercise no perceptible effect on the movements of massive solid bodies like the planets, but substantial enough to exert a very important influence on more attenuated substances moving with great velocity. The effect of the resistance of the ether is to retard the tangential motion, and allow the attractive force of gravity to draw the body nearer to the Sun, by which the dimensions of the orbit are continually contracted and the velocity in it augmented. The final result will be that after the lapse of ages this comet will fall into the Sun; this body, a mere hazy cloud, continually flickering as it were like a celestial moth round the great luminary, is at some distant period destined to be mercilessly consumed. Now the discovery of this ether is deeply interesting as bearing on other important physical questions, such as the undulatory theory of light; and the probability of the future absorption of comets by the Sun is important as connected with a very interesting speculation by Professor William Thomson, who has suggested that the heat and light of the Sun may be from time to time replenished by the falling in and absorption of countless meteors which circulate round him; and here we have a cause revealed which may accelerate or produce such an event.

In the progress of science it often happens that a particular class of observations, all at once, and owing to some peculiar circumstance, attracts very general attention and becomes deeply interesting. This has been the case within the last few years in reference to observations of the Sun's disc, which were at one time made by very few individuals, and were indeed very much neglected both by professional and amateur Astronomers. During this season of comparative neglect, there were not, however, wanting some enthusiastic individuals, who were in silence and seclusion obtaining data of great importance.

On the 1st of September last, at 11<sup>h</sup> 18<sup>m</sup> A.M., a distinguished Astronomer, Mr. Carrington, had directed his telescope to the Sun, and was engaged in observing his spots, when suddenly two intensely luminous bodies burst into view on its surface. They moved side by side through a space of about 35,000 miles, first increasing in brightness, then fading away; in 5 minutes they had vanished. They did not alter the shape of a group of large black spots which lay directly in their paths. Momentary as this remarkable phenomenon was, it was fortunately witnessed and confirmed, as to one of the bright lights, by another observer, Mr. Hodgson at Highgate, who by a happy coincidence had also his telescope directed to the great luminary at the same instant. It may be, therefore, that these two gentlemen have

actually witnessed the process of feeding the Sun, by the fall of meteoric matter; but however this may be, it is a remarkable circumstance, that the observations at Kew show that on the very day, and at the very hour and minute of this unexpected and curious phenomenon, a moderate but marked magnetic disturbance took place; and a storm or great disturbance of the magnetic elements occurred four hours after midnight, extending to the southern hemisphere. Thus is exhibited a seeming connexion between magnetic phenomena and certain actions taking place on the Sun's disc—a connexion, which the observations of Schwabe, compared with the magnetical records of our Colonial Observatories, had already rendered nearly certain. The remarkable results derived from the comparison of the magnetical observations of Captain Maguire on the shores of the Polar Sea, with the contemporaneous records of these observatories, have been described by me on a former occasion. The delay of the Government in re-establishing the Colonial Observatories has hitherto retarded that further development of the magnetic laws, which would doubtless have resulted from the prosecution of such researches.

We may derive an important lesson from the facts above alluded to. Here are striking instances in which independent observations of natural phenomena have been strangely and quite unexpectedly connected together: this tends powerfully to prove, if proof were necessary, that if we are really ever to attain to a satisfactory knowledge of Nature's laws, it must be accomplished by an assiduous watching of all her phenomena, in every department into which Natural Science is divided. Experience shows that such observations, if made with all those precautions which long practice combined with natural acuteness teaches, often lead to discoveries, which cannot be at all foreseen by the observers, though many years may elapse before the whole harvest is reaped.

I cannot allude to the subject of Arctic voyages without congratulating the Association on the safe return of Sir Leopold M'Clintock and his gallant band, after accomplishing safely and satisfactorily the object of their interesting mission. The great results accomplished with such small means, and chiefly by the display of those qualities of indomitable courage, energy and perseverance which never fail the British seaman in the hour of need, are the theme of general admiration; but I may be permitted in passing to express some regret, that it was left to the devoted affection of a widowed lady, slightly aided by private contributions, to achieve a victory in which the honour of the nation was so largely involved,—the rather that the danger of the enterprise,—the pretext for non-interference—was much enhanced thereby, and the accessions to our scientific and geographical knowledge proportionably curtailed.

The instances to which I have alluded are only a few of many which could be adduced of an insufficient appreciation of certain objects of scientific research. Large sums are expended on matters connected

with science, but this is done on no certain and uniform system; and there is no proper security that those who are most competent to give good advice on such questions, should be the actual persons consulted. It was partly with the hope of remedying these defects and of generally improving the position of science in the country in its relation to the Government, that the Parliamentary Committee of this Association was established; and it was partly with the same hope that I was induced to accept the honourable office of President of the Royal Society, though conscious at the time that there were very many far better qualified than myself to hold it. Many of those whom I am now addressing are aware of the steps which were adopted by the Parliamentary Committee, and subsequently by the Committee of Recommendations of this Association, for the purpose of collecting the opinions of the cultivators of science on the question,—Whether any measures could be adopted by Government or Parliament that would improve our position? The question was afterwards referred to and discussed by the Council of the Royal Society, who, on the 15th of January, 1857, agreed upon twelve resolutions in reply thereto. These resolutions recommend, among other things, that Government grants in aid of local funds should be applied towards the teaching of science in schools, the formation of Provincial Museums and Libraries, and the delivery of lectures by competent persons, accompanied by examinations; and finally, that some existing scientific body, or some Board to be created for the purpose, should be formally recognized, which might advise the Government on all matters connected with science, and especially on the prosecution, reduction, and publication of scientific researches, and the amount of Parliamentary or other grants in aid thereof; also on the general principles to be adopted in reference to public scientific appointments, and on the measures necessary for the more general diffusion of a knowledge of physical science among the nation at large; and which might also be consulted by the Government on the grants of pensions to the cultivators of science. I was requested to transmit these resolutions to Lord Palmerston, and also to the Parliamentary Committee of this Association. Since that period these resolutions have been discussed by that Committee; but partly because some of its most influential members have expressed grave doubts as to the expediency of urging their adoption at all, and partly from the want of a favourable opportunity for bringing them forward, nothing further has as yet been done. I thought, however, that the time was arrived at which it was only proper that I should explain the steps which had been already taken, and the actual position in which the question now stands. If it be true, as some of our friends imagine, that the recognition of such a body as has been above described, however useful it might prove if the public were disposed to put confidence in its suggestions, would only augment that feeling of jealousy which is disposed to view every application for aid to scientific research in the light of a request for some personal boon, to be bestowed on some favoured individual, then indeed its institution would not

be expedient. I only wish that persons who entertain such views, would pay some attention to the working of the Government Grant Committee of the Royal Society, a body composed of forty-two persons selected from among the most eminent cultivators of science, and which is entrusted with the distribution of an annual sum of £1000, placed by Parliament at the disposal of the Royal Society at the suggestion of Lord John Russell, in aid of scientific inquiries. One of the rules of that Committee is, that no sum whatever shall be given to defray the merely personal expenses of the experimenters; all is spent on materials and the construction or purchase of instruments, except in a very few and rare instances in which travelling expenses form the essential feature of the outlay. A list of the objects to which the grants are devoted has been published by Parliament; among them are interesting investigations into the laws of heat, the strength of materials used in building, the best form of boilers, from the bursting of which so many fatal accidents are continually occurring, the electric conductivity of metals, so important for telegraphic communication, and into many other questions, in the solution of which the public generally have the deepest interest. The cost of these researches has been defrayed by these valuable grants. They have provided also for the construction of better and standard meteorological and magnetical instruments, for the execution of valuable drawings of scarce fossils and zoological specimens collected with great labour by distinguished naturalists, for the reduction and publication of astronomical observations by some of our most highly esteemed Astronomers, and for physiological researches which have an important bearing on our knowledge of the human frame. Time indeed would fail me were I to attempt to describe all the good done and perhaps evil prevented by the distribution of these grants; and yet no portion of the money can be said to be really received by those to whom it is appropriated, inasmuch as it is all spent in the various means and appliances of research; in short, to quote from a letter addressed to the Secretary of the Treasury, at a time when the grant was temporarily withheld, "by the aid of this contribution, the Government has, in fact, obtained for the advancement of science and the national character, the personal and gratuitous services of men of first-rate eminence, which, without this comparatively small assistance, would not have been so applied." I think that we were justified in terming this assistance small; for it is really so in comparison with the amount of other sums which are applied to analogous objects, but without that wholesome control of intelligent distributors, thoroughly and intimately conversant with the characters and competency of those who apply for the grants. The recognition of such a Board as has been sketched out by the Council of the Royal Society, may not lead to a greater expenditure of public money, indeed it is much more likely to curtail it; as some who now apply for aid through the interest of persons having influence with those in authority, who are generally but ill-informed on the subject-matter of the application, would hesitate long before they

made a similar request to those who are thoroughly conversant with it; and it is on this account that comparatively few of the applications to the Government Grant Committee are rejected. Moreover, inasmuch as every grant passed by the proposed Board would afterwards receive the jealous scrutiny of Parliament, whose sanction must of course be obtained, I am disposed to think that were I to support the establishment of such a scientific Council, or the formal recognition by the State of some existing scientific body in that capacity, I should be advocating that which would prove a valuable addition to the Institutions of my country.

Before I finally conclude my observations on the important question I have introduced to your notice, and on which perhaps I have already said too much at the risk of wearying you, I must guard myself against one misapprehension, and that is, that we are anxious to obtain a large augmentation of the £1000 now voted by Parliament. This is by no means our wish; that annual sum is in ordinary years sufficient, and sometimes more than sufficient, and there is nothing that would be more deprecated than any large increase; but there is a very general feeling among those most competent to form an opinion on these matters, that when the well-considered interests of science and the national good demand an extraordinary outlay, such as cannot be defrayed out of the proceeds of the ordinary yearly grant,—as, for example, for surveying and exploring expeditions, for the establishment and maintenance of magnetic observatories, for the purchase of costly astronomical instruments, for expensive astronomical excursions, such as that to Teneriffe,—that the expediency of the grant is more likely to be properly investigated and tested, if referred to those whose avocations have given them the requisite knowledge, than if the concession or rejection of the proposal be permitted to depend on such accidents, as, whether this or that individual apply, or this or that statesman fill the office of Chancellor of the Exchequer.

I trust that I may be pardoned the long digression in which I have indulged, in consideration of the importance of the subject.

Having detailed some of the valuable services of our amateur Astronomers, let me not be accused of being unjust to the professional contributors to the data of that noble science. Most valuable Star Catalogues have resulted from the labours of our public Observatories, and from Greenwich in particular. There are also two Observatories which have, as it were, a *quasi* public character, viz. the Radcliffe Observatory and that of Armagh, which have contributed much to this department of Astronomy. Your former President, the accomplished and learned Dr. Robinson of Armagh, has lately presented to the astronomical world a Catalogue of the places of more than 5000 stars, and in so doing has conferred a most important benefit on his favourite science.

But it would be an unpardonable omission were I to neglect to express our gratitude to our great National Institution at Greenwich, for the manner in

which it has consistently discharged the task imposed upon it by its founder and those who inaugurated its first proceedings. The duty assigned to it was "to rectify the tables of the motions of the heavens and the places of the fixed stars, in order to find out the so much desired longitude at sea, for perfecting the art of navigation;" and gloriously has it executed its task. For two centuries it has been at work, endeavouring to give to the determinations of the places of the principal fixed stars and of the heavenly bodies of our own solar system, and more especially of the Moon, the utmost degree of precision; and during the same period, the master minds of Europe have been engaged in perfecting the analytical theory, by which the many and most perplexing inequalities of the Moon's motion must be accounted for and represented, before Tables can be constructed giving the place of our satellite with that accuracy that the modern state of science demands.

The very important task of calculating such Tables has just been finished. Our able and accomplished Director of the National Observatory, Mr. Airy, had caused all the observations of the Moon made at Greenwich, from 1750 to 1830, to be reduced upon one uniform system, employing constants derived from the best modern researches; and a distinguished Danish Professor, who had been for some time engaged in calculating new Tables of the Moon, availed himself of the data so furnished. Professor Hansen happily brought to his task all the accomplishments of a practised observer, and of one of the most able analysts of modern times, combined with the most determined industry and perseverance. In the completion of it he was liberally assisted by our Government, at a time when an unhappy war had deprived the Danish Government of the means of further aiding their Professor, and a great astronomical work had been suspended for want of £300, a sum which many do not hesitate to spend on the purchase of some useless luxury. Professor Hansen's Tables are now finished and published. They agree admirably with the Greenwich Observations with which they have been compared, and the mode of their execution has been approved by those competent to express an opinion on such a subject. They have been rewarded also with the Gold Medal of the Astronomical Society, a distinction never lightly bestowed.

In paying this tribute to the merit of Professor Hansen, I must not be understood as wishing to ignore, far less depreciate, that of three very eminent geometers—Plana, Lubbock, and Pontécoulant, who have devoted years of anxious and perhaps ill-requited labour to the investigation of the Lunar inequalities, but who have never yet embodied the results in the only form useful to Navigation, that of Tables.

A curious controversy has lately arisen on the subject of the acceleration of the Moon's motion, which is now exciting great interest among mathematicians and physical astronomers. Professor Adams and M. Delaunay take one view of the question; MM. Plana, Pontécoulant, and Hansen the other. Mr. Airy, Mr. Main the President of the Astronomical Society, and

Sir John Lubbock support the conclusions at which Professor Adams has arrived. The question in dispute is strictly mathematical; and it is a very remarkable circumstance in the history of Astronomy, that such great names should be ranged on opposite sides, seeing that the point involved is really no other than whether certain analytical operations have been conducted on right principles; and it is a proof therefore, if any were wanting, of the extraordinary complexity and difficulty of these transcendental inquiries. The controversy is of the following nature:—The Moon's motion round the Earth, which would be otherwise uniform, is disturbed by the Sun's attraction; any cause therefore which affects the amount of that attraction affects also the Moon's motion: now, as the excentricity of the Earth's orbit is gradually decreasing, the average distance of the Sun is slightly increasing every year, and his disturbing force becomes less; hence the Moon is brought nearer the Earth, but at the rate of less than one inch yearly; her gravitation towards the Earth is greater, and her motion is proportionably accelerated. It is on the secular acceleration of the Moon's mean motion, arising from this minute yearly approach, that the dispute has arisen; so infinitesimally small are the quantities within the reach of modern analysis. Mr. Adams asserts that his predecessors have improperly omitted the consideration of the effect produced by the action of that part of the Sun's disturbing force which acts in the direction of a tangent to the Moon's orbit, and which increases the velocity; his opponents deny that it is necessary to take this into account at all. Had not M. Delaunay, an able French analyst, by a perfectly independent process, confirmed the results of Professor Adams, we should have had the English and Continental Astronomers waging war on an algebraical question. On the other hand, however, the computations of the ancient Lunar Eclipses support the views of the Continent; but if Mr. Adams's mathematics are correct, this only shows that there must be other causes in operation as yet undiscovered, which influence the result; and it is not at all unlikely that this most curious and interesting controversy will eventually lead to some important discovery in Physical Astronomy.

You are aware that at the suggestion of Sir John Herschel an instrument was constructed for the Kew Observatory, to which the name of Photoheliograph has been given, because it is adapted solely to the purpose of obtaining photographic representations of the appearances on the Sun's disc. Many difficulties have been encountered in the use of this instrument, but by the zealous exertions of the late Mr. Welsh, Mr. Beckley, and Mr. De la Rue, they have been overcome. It is to the last-named gentleman, so distinguished for his successful prosecution of celestial photography, that the Royal Society have entrusted a grant of money to enable him to transport the Photoheliograph to Spain, to observe the total eclipse of the Sun, which is now approaching, and great interest will attach to records of the phenomena of the eclipse thus obtained.

In Chemistry I am informed that great activity has been displayed, espe-

cially in the organic department of the science. For several years past processes of substitution (or displacement of one element or organic group by another element or group more or less analogous) have been the main agents employed in investigation, and the results to which they have led have been truly wonderful; enabling the chemist to group together separate compounds of comparatively simple constitution into others much more complex, and thus to imitate, up to a certain point, the phenomena which take place within the growing plant or animal. It is not indeed to be anticipated that the chemist should ever be able to produce by the operations of the laboratory the arrangement of the elements in the forms of the vegetable cell or the animal fibre; but he may hope to succeed in preparing some of the complex results of secretion or of chemical changes produced within the living organism,—changes, which furnish definite crystallizable compounds, such as the formiates and the acetates, and which he has actually obtained by operations independent of the plant or the animal.

Hofmann, in pursuing the chemical investigation of the remarkable compound which he has termed *Triethylphosphine*, has obtained some very singular compound ammonias. Triethylphosphine is a body which takes fire spontaneously when its vapour is mixed with oxygen, at a temperature a little above that of the body. It may be regarded as ammonia in which an atom of phosphorus has taken the place of nitrogen, and in which the place of each of the three atoms of hydrogen in ammonia is supplied by ethyl, the peculiar hydrocarbon of ordinary alcohol. From this singular base Hofmann has succeeded in procuring other coupled bases, which though they do not correspond to any of the natural alkalies of the vegetable kingdom, such as morphia, quinia, or strychnia, yet throw some light upon the mode in which complex bodies more or less resembling them have been formed.

The power which nitrogen possesses of forming a connecting link between the groups of substances of comparatively simple constitution, has been remarkably exemplified by the discovery of a new class of amide acids by Griess, in which he has pointed out a new method, which admits of very general application, of producing complex bodies related to the group of acids, in some measure analogous to the Poly-ammonias of Hofmann.

Turning to the practical applications of Chemistry, we may refer to the beautiful dyes now extracted from aniline, an organic base formerly obtained as a chemical curiosity from the products of the distillation of coal-tar, but now manufactured by the hundred-weight in consequence of the extensive demand for the beautiful colours known as Mauve, Magenta, and Solferino, which are prepared by the action of oxidizing agents, such as bichromate of potash, corrosive sublimate, and iodide of mercury upon aniline.

Nor has the Inorganic department of Chemistry been deprived of its due share of important advances. Schönbein has continued his investigations upon ozone, and has added many new facts to our knowledge of this interesting substance; and Andrews and Tait, by their elaborate investigations,



have shown that ozone, whether admitted to be an allotropic modification of oxygen or not, is certainly much more dense than oxygen in its ordinary condition.

In Metallurgy we may point to the investigations of Deville upon the platinum group of metals, which are especially worthy of remark on account of the practical manner in which he has turned to account the resources of the oxyhydrogen blowpipe, as an agent which must soon be very generally adopted for the finer description of metallurgic operations at high temperatures. By using lime as the material of his crucibles and as the support for the metals upon which he is operating, several very important practical advantages have been obtained. The material is sufficiently infusible to resist the intense heat employed; it is a sufficiently bad conductor of heat to economize very perfectly the high temperature which is generated; and it may be had sufficiently free from foreign admixture to prevent it from contaminating the metals upon which the operator is employed.

The bearing of some recent geological discoveries on the great question of the high antiquity of Man was brought before your notice at your last Meeting at Aberdeen by Sir Charles Lyell in his opening address to the Geological Section. Since that time many French and English naturalists have visited the valley of the Somme in Picardy, and confirmed the opinion originally published by M. Boucher de Perthes in 1847, and afterwards confirmed by Mr. Prestwich, Sir C. Lyell, and other geologists from personal examination of that region. It appears that the position of the rude flint-implements, which are unequivocally of human workmanship, is such, at Abbeville and Amiens, as to show that they are as ancient as a great mass of gravel which fills the lower parts of the valley between those two cities, extending above and below them. This gravel is an ancient fluvial alluvium by no means confined to the lowest depressions (where extensive and deep peat-mosses now exist), but is sometimes also seen covering the slopes of the boundary hills of chalk at elevations of 80 or 100 feet above the level of the Somme. Changes therefore in the physical geography of the country, comprising both the filling up with sediment and drift and the partial re-excavation of the valley, have happened since old river-beds were at some former period the receptacles of the worked flints. The number of these last, already computed at above 1400 in an area of fourteen miles in length and half a mile in breadth, has afforded to a succession of visitors abundant opportunities of verifying the true geological position of the implements.

The old alluvium, whether at higher or lower levels, consists not only of the coarse gravel with worked flints above mentioned, but also of superimposed beds of sand and loam, in which are many freshwater and land shells, for the most part entire, and of species now living in the same part of France. With the shells are found bones of the Mammoth and an extinct Rhinoceros, *R. tichorhinus*, an extinct species of deer, and fossil remains of the Horse, Ox, and other animals. These are met with in the overlying beds, and sometimes

also in the gravel where the implements occur. At Menchecourt, in the suburbs of Abbeville, a nearly entire skeleton of the Siberian Rhinoceros is said to have been taken out about forty years ago, a fact affording an answer to the question often raised, as to whether the bones of the extinct mammalia could have been washed out of an older alluvium into a newer one, and so redeposited and mingled with the relics of human workmanship. Far-fetched as was this hypothesis, I am informed that it would not, if granted, have seriously shaken the proof of the high antiquity of the human productions, for that proof is independent of organic evidence or fossil remains, and is based on physical data. As was stated to us last year by Sir C. Lyell, we should still have to allow time for great denudation of the chalk, and the removal from place to place, and the spreading out over the length and breadth of a large valley of heaps of chalk flints in beds from 10 to 15 feet in thickness, covered by loams and sands of equal thickness, these last often tranquilly deposited, all of which operations would require the supposition of a great lapse of time.

That the mammalian fauna preserved under such circumstances should be found to diverge from the type now established in the same region, is consistent with experience; but the fact of a foreign and extinct fauna was not needed to indicate the great age of the gravel containing the worked flints.

Another independent proof of the age of the same gravel and its associated fossiliferous loam is derived from the large deposits of peat above alluded to in the valley of the Somme, which contain not only monuments of the Roman, but also those of an older Stone Period, usually called Celtic. Bones also of the Bear, of the species still inhabiting the Pyrenees, and of the Beaver, and many large stumps of trees, not yet well examined by botanists, are found in the same peat, the oldest portion of which belongs to times far beyond those of tradition; yet distinguished geologists are of opinion that the growth of all the vegetable matter, and even the original scooping out of the hollows containing it, are events long posterior in date to the gravel with flint implements, nay, posterior even to the formation of the uppermost of the layers of loam with freshwater shells overlying the gravel.

The exploration of caverns, both in the British Isles and other parts of Europe, has in the last few years been prosecuted with renewed ardour and success, although the theoretical explanation of many of the phenomena brought to light seems as yet to baffle the skill of the ablest geologists. Dr. Falconer has given us an account of the remains of several hundred Hippopotami obtained from one cavern near Palermo, in a locality where there is now no running water. The same palæontologist, aided by Col. Wood of Glamorganshire, has recently extracted from a single cave in the Gower peninsula of South Wales, a vast quantity of the antlers of a reindeer (perhaps of two species of reindeer), both allied to the living one. These fossils are most of them shed horns; and there have been already no less than 1100 of them dug out of the mud filling one cave.

In the cave of Brixham in Devonshire, and in another near Palermo in

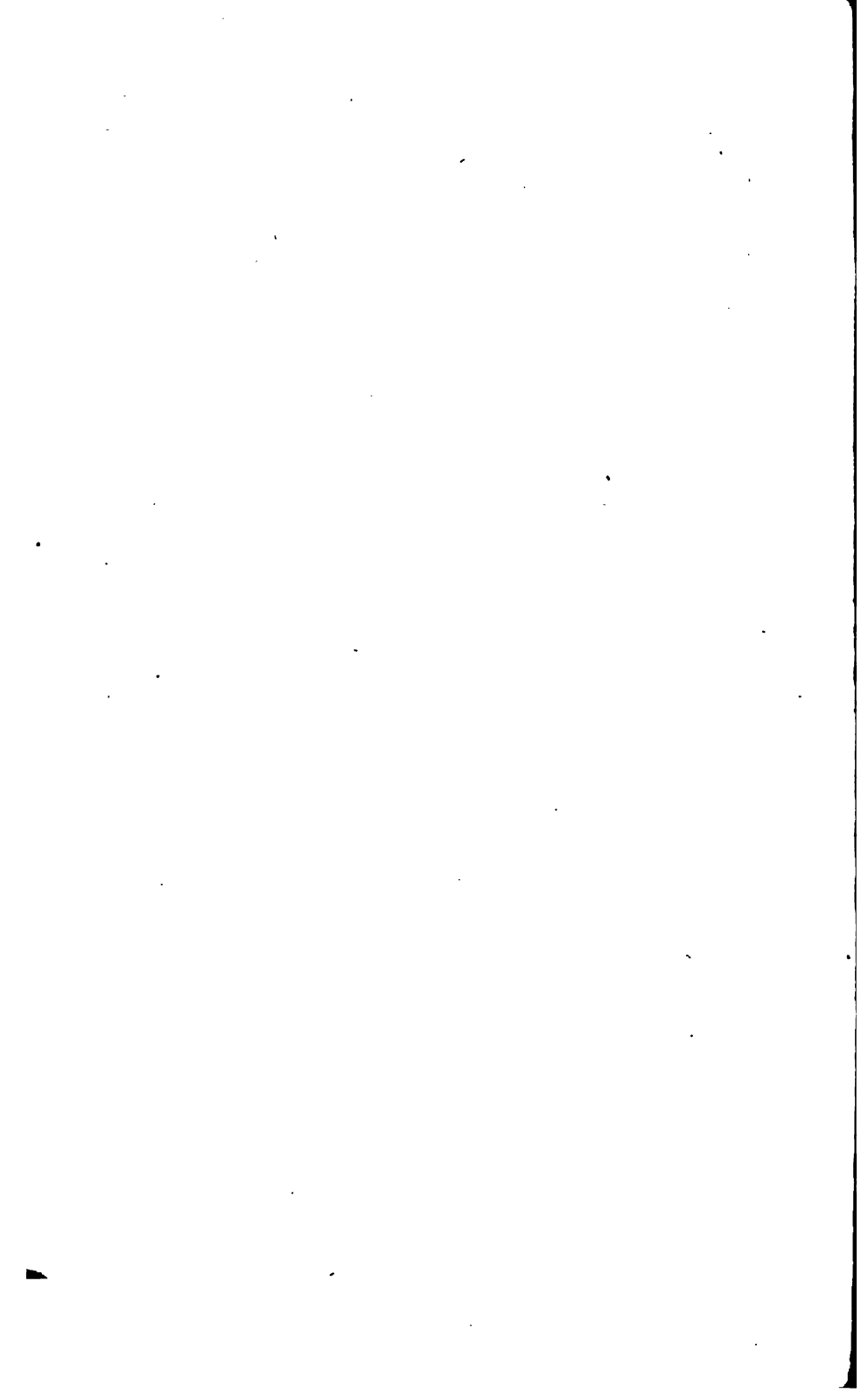
Sicily, flint implements were observed by Dr. Falconer, associated in such a manner with the bones of extinct mammalia, as to lead him to infer that Man must have coexisted with several lost species of quadrupeds; and M. de Vibraye has also this spring called attention to analogous conclusions at which he has arrived, by studying the position of a human jaw with teeth, accompanied by the remains of a mammoth, under the stalagmite of the Grotto d'Arcis near Troyes in France.

In the recent progress of Physiology, I am informed that the feature perhaps most deserving of note on this occasion is the more extended and successful application of Chemistry, Physics, and the other collateral sciences to the study of the Animal and Vegetable Economy. In proof I refer to the great and steady advances which have, within the last few years, been made in the chemical history of Nutrition, the statics and dynamics of the blood, the investigation of the physical phenomena of the senses, and the electricity of nerves and muscles. Even the velocity of the nerve-force itself has been submitted to measurement. Moreover, when it is now desired to apply the resources of Geometry or Analysis to the elucidation of the phenomena of life, or to obtain a mathematical expression of a physiological law, the first care of the investigator is to acquire precise experimental data on which to proceed, instead of setting out with vague assumptions and ending with a parade of misdirected skill, such as brought discredit on the school of the mathematical physicians of the Newtonian period.

But I cannot take leave of this department of knowledge without likewise alluding to the progress made in scrutinizing the animal and vegetable structure by means of the microscope—more particularly the intimate organization of the brain, spinal cord, and organs of the senses; also to the extension, through means of well-directed experiment, of our knowledge of the functions of the nervous system, the course followed by sensorial impressions and motorial excitement in the spinal cord, and the influence exerted by or through the nervous centres on the movements of the heart, blood-vessels and viscera, and on the activity of the secreting organs;—subjects of inquiry, which, it may be observed, are closely related to the question of the organic mechanism whereby our corporeal frame is influenced by various mental conditions.

And now, in conclusion, I may perhaps be permitted to express the hope that the examples I have given of some of the researches and discoveries which occupy the attention of the cultivators of science, may have tended to illustrate the sublime nature, engrossing interest and paramount utility of such pursuits, from which their beneficial influence in promoting the intellectual progress and the happiness and well-being of mankind may well be inferred. But let us assume that to any of the classical writers of antiquity, sacred or profane, a sudden revelation had been made of all the wonders involved in Creation accessible to man; that to them had been disclosed not only what we now know, but what we are to know hereafter, in some future

age of improved knowledge; would they not have delighted to celebrate the marvels of the Creator's power? They would have described the secret forces by which the wandering orbs of light are retained in their destined paths; the boundless extent of the celestial spaces in which worlds on worlds are heaped; the wonderful mechanism by which light and heat are conveyed through distances which to mortal minds seem quite unfathomable; the mysterious agency of electricity, destined at one time to awaken men's minds to an awful sense of a present Providence, but in after-times to become a patient minister of man's will, and convey his thoughts with the speed of light across the inhabited globe; the beauties and prodigies of contrivance which the animal and vegetable world display, from mankind downwards to the lowest zoophyte, from the stately oak of the primeval forest to the humblest plant which the microscope unfolds to view; the history of every stone on the mountain brow, of every gay-coloured insect which flutters in the sun-beam;—all would have been described, and all which the discoveries of our more fortunate posterity will in due time disclose, and in language such as none but they could command. It is reserved for future ages to sing such a glorious hymn to the Creator's praise. But is there not enough now seen and heard to make indifference to the wonders around us a deep reproach, nay, almost a crime? If we have neither leisure nor inclination to track the course of the planet and comet through boundless space; to follow the wanderings of the subtle fluid in the galvanic coil or the nicely poised magnet; to read the world's history written on her ancient rocks, the sepulchres of stony relics of ages long gone past, to analyse with curious eye the wonderful combinations of the primitive elements and the secret mysteries of form and being in animal and plant; discovering everywhere connecting links and startling analogies and proofs of adaptation of means to ends;—all tending to charm the senses, to teach, to reclaim a being, who seems but a creeping worm in the presence of this great Creation—What, I repeat, if we will not or cannot do these things, or any of these things, is that any reason why these speaking marvels should be to us almost as though they were not? *Marvels* indeed they are, but they are also mysteries, the unravelling of some of which tasks to the utmost the highest order of human intelligence. Let us ever apply ourselves seriously to the task, feeling assured that the more we thus exercise, and by exercising improve our intellectual faculties, the more worthy shall we be, the better shall we be fitted to come nearer to our God.



# **A D D R E S S**

**TO THE**

**GEOGRAPHICAL AND ETHNOLOGICAL SECTION**

**OF THE**

**BRITISH ASSOCIATION,**

**AT THE OXFORD MEETING OF 1860.**

**BY ITS PRESIDENT,**

**SIR RODERICK IMPEY MURCHISON, D.C.L., F.R.S.**

**VICE-PRESIDENT OF THE ROYAL AND E. GEOGRAPHICAL SOCIETIES, AND  
DIRECTOR-GENERAL OF THE GEOLOGICAL SURVEY OF THE UNITED KINGDOM.**

OXFORD :

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## A D D R E S S .

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LADIES AND GENTLEMEN,

During the last two years only, the President of each Section of the British Association has opened the business of the Meeting by a short address, and it fell to my lot in 1858 to offer a few words to the Geographers and Ethnologists who were assembled at Leeds. I there explained to the assembled members the satisfaction I felt in proposing, at the Edinburgh Meeting in 1850, the formation of a separate Section for Geography and Ethnography, to represent the letter E left vacant by our Medical Associates who had seceded to found an association of their own.

Until that year Geography had been attached exclusively to the Geological Section, in which in truth it was submerged by the numerous Memoirs of my brethren of the rocks, whilst Ethnology, forming a Sub-Section, with difficulty obtained a proper place of meeting. Now, however, both these sciences are, I am happy to say, fully represented in our Section, and I trust that the result of the coming week will shew, that the subjects to be illustrated will attract so many members to our hall, as will prove that Geography in its comprehensive sense is as popular in Oxford as it has proved to be in the metropolis.

Before I enter upon the consideration of any memoirs which may be laid before us, let me allude to a few of the subjects of deep interest which have been illustrated by British Geographers in various parts of the world in the two years which have elapsed since I had the honour of last presiding over you.

In Africa, the earlier discoveries of that great traveller



Livingstone have been followed by other researches of his companions and himself, which, as far as they go, have completely realized his anticipation of detecting large elevated tracts, truly *Sanatoria* as compared with those swampy and low regions near the coast, which have impressed too generally on the minds of our countrymen the impossibility of sustaining a life of exertion in any intertropical region of Africa. The opening out of the Shire river, that grand affluent of the Zambesi, with the description of its banks and contiguous lofty terraces and mountains, and the development of the healthfulness of the tract, is most refreshing knowledge, the more so as it is accompanied by the pleasing notice, that in this tract the slave trade is unknown except by the rare passage of a gang from other parts; whilst the country so teems with rich vegetable products, including cotton, and herds of elephants, as to lead us to hope that a spirit of profitable barter, which powerfully animates the natives, may lead to their civilization—and thus prove the best means of eradicating the commerce in human beings.

Whilst Livingstone was sailing to make his last venture, and to realize the promise he had given to his faithful Macololo friends, that he would return to them, and bring them kind words from the Queen of the people who love the black man, Captains Burton and Speke were returning from their glorious exploits into a more central and northern region of South Africa, where they had discovered two great internal lakes or fresh water Seas, each of not less than 300 miles in length.

I may here notice to the honour of our Government, and particularly to that of the present Secretary for Foreign Affairs, that Captain Speke, associated with another officer of the Bengal army, Captain Grant, has received £2,500, to enable him to terminate his examination of the great Nyanza Lake, under the equator, and we have reason to hope that he will find the chief feeders of the White Nile flowing out from its northern extremity, and thus determine the long-sought problem of one of the chief sources of that classic stream.

I also trust that in the last and most arduous portion of his efforts in proceeding northwards, he will be assisted through the cooperation of H.M. Consul at Khartoum on the Upper

Nile in traversing the country immediately to the north of the equator, where no traveller ancient or modern has ever penetrated and which is inhabited by wild and barbarous natives. After a residence of sixteen years in that region, and having made many trading expeditions to the confines of this unknown region, that bold and experienced man, Consul Petherick, is, I am persuaded, the only European who can afford real assistance to Captains Burton and Grant, and if by their united efforts the true source or sources of the Nile should be discovered, Britain will have attained a distinction hitherto sought in vain from the days of the Roman Empire.

During the week of our meeting, Mr. Petherick will bring before us his project, which I trust you will support\*, for effecting either a junction with Captain Speke, or of affording effective assistance, without which it is much to be feared that the gallant Captain will never be able to traverse the savage tracts which intervene between the Nyanza Lake and that highest part of the Nile to which any traveller has ascended.

If we turn to the Polar Circle, we see what individual British energy has been able to elicit from the frozen North. There, indeed, notwithstanding many a well found expedition sent out to ascertain the fate of Franklin, all our efforts as a nation had failed, when the energy and persevering devotion of a woman, backed only by a few zealous and abiding friends, accomplished the glorious end of satisfying herself, and of proving to her admiring country, that in sacrificing his life her heroic husband and his brave companions had been the first discoverers of the North West Passage.

For her noble and devoted conduct in having persevered through many years of her life to send out expeditions at her own cost, until she at length developed the fate of the Erebus and Terror, the Royal Geographical Society of London has rightly judged in awarding to Lady Franklin one of their gold medals, whilst the other has been appropriately given to that gallant and skilful officer Sir Leopold McClintock, who in the little yacht the Fox so thoroughly accomplished his arduous mission. He not only ascertained the death of Franklin, and the subsequent abandonment of his ships, but

\* A Subscription List in furtherance of this great object is opened, headed by Lord Ashburton and Sir Roderick Murchison.

also shewed, that the great navigator had discovered vast breadths of Arctic lands and seas which were entirely unknown when he left our shores, and have remained so until the truth was revealed by the expedition of the Fox.

The geographer who compares the map of the Arctic regions as laid down by Parry and others up to the year 1845, and marks on it all that Franklin is now known to have added in the two brief summers before he was beset, and then inspects any one of the most recent maps, even up to the year 1858 inclusive, and traces the discoveries made by McClintock and his associates, Hobson, Young, and Walker, will see what vast additions to geographical knowledge have been made by the last expedition of Lady Franklin.

Such services are indeed worthy of the highest national reward, and I have, I am happy to say, reason to know, that a monument to the commemoration of the glorious deeds of Franklin and of his having been the first to discover a North West Passage will be erected, and that the officers and crew of the Fox will receive that recompense to which they are so justly entitled at the hands of their admiring countrymen.

Whilst on this subject I may well express the satisfaction and pride I feel as the President of this Section, that the officers of the British Association have asked us, the Geographers, to bring forward one of our distinguished men to deliver a lecture on some one of our manifold subjects, before the body of men of Science assembled at Oxford. As this is the first occasion since our foundation on which geographical discovery has been considered to be of sufficient scientific importance to occupy the attention of the whole meeting, I rejoice in the fact, and that Captain Sherard Osborn, so well known to us through his charming 'Arctic Stray Leaves,' and other books, as well as by his laurels won in the Crimea and the sea of Azof, is to be the lecturer, and that he who is so experienced an Ice-man is to give us a sketch of the discoveries of Franklin, as laid open by the last researches of Sir Leopold McClintock.

And here I may well say that every justice will be done to any subject connected with the conditions of icy seas, including the proposed submarine telegraph; for never at any of our former meetings have I seen so many explorers met

together who have rendered their names eminent through Arctic and Antarctic discoveries. Under their observation the paper which is to be brought before us by Capt. Parker Snow, of the Merchant Marine, warmly urging a further search to recover the precious scientific records of the Erebus and Terror, will be ably scrutinized. The names of Admiral Sir James Ross, Sir Edward Belcher, Captains Ommaney and Sherard Osborn, when united with those of Sir J. Richardson and Dr. Rae, are truly guarantees that the question will have so much light thrown upon it as will either satisfy the public that no additional important results as respects the lost expedition can be achieved, or will stimulate us to fresh exertions. For, though all the Arctic voyagers with whom I have conversed are satisfied that there is now no hope of saving a human life, still every man of science must wish, that strenuous efforts should still be made to recover, if possible, some more of the many scientific records of the lost expedition which may have been left in various places around the spot where Franklin breathed his last.

In the vast possessions of British North America much additional knowledge has been gained by the successful explorations of Palliser and his associates, Hector, Blakiston, and Sullivan, not only as respects the great fertile prairies watered by the Saskatchewan and its affluents, but also the practicability of traversing the Rocky Mountains within our territories by passes lower than any which exist to the south of the boundary of the United States.

At this stage of our enquiries it would be hazardous perhaps to speculate on these passes being rendered available for railroads; the more so, as the wild region lying to the west of the Rocky Mountains—i. e. between them and those parts of British Columbia which are gold bearing, and are beginning to be inhabited by civilized people—is as yet an unexplored woody region. We may hope however, that such routes of communication will be established as will connect the Red river settlements with the prairies of the Saskatchewan, and these last with the rich auriferous tracts of British Columbia. And if the most northern lines be found to be too difficult for railway communication, through the severity of the climate and physical obstacles, let us hope that by giving and taking

ground in an amicable manner with our kinsmen of the United States, we may be enabled by a more Southern railroad to traverse the prairies on either side of the neutral boundary, and then pass down the river Columbia to Vancouver Island. By this operation the great Gulf of St. Lawrence and Hudson's Bay on the east may eventually be placed in communication with the noble roadsteads of Vancouver Island and the adjacent mainland on the Pacific. At all events, Britain will doubtless not be slow in establishing communications between the Atlantic and Pacific, first by the electric telegraph, next by ordinary roads, and finally, it is to be hoped, in part at least, by railroads.

On these subjects we are to be favoured at this Meeting with a paper by Captain Synge, in addition to the *vivâ voce* communications of Captain Palliser and his associates.

Having not as yet had access to many of the papers which are to be communicated to this Section, I can allude to a few more of them only. In a Memoir on the Geographical distribution of Plants in Asia Minor and Armenia by my distinguished friend M. Pierre de Tchihatcheff you will find some remarkable results as flowing from the long-continued researches of that ardent and successful traveller. After accounting for the absence of some plants and the profusion of others in given localities as dependent on climatal conditions (an example of which is, that the grape there flourishes in one tract at the great height of nearly 6,000 feet above the Sea,) M. de Tchihatcheff brings out some striking statistical data, showing the vastly greater abundance and variety of vegetation in Asia Minor compared with that of any other country. He points out that the plants of five mountains only amount in number to double the entire quantity of British plants, and concludes with an eloquent regret that these classical regions, so blessed by the hand of the Creator, and which in the earlier history of Mankind were replete with highly civilized communities, should now, through misgovernment, be the scene of desolation, oppression and barbarity.

Another distinguished Russian geographer, M. N. Khanikoff, who has explored large portions of Persia and the adjoining countries, will bring before us his maps and descriptions of the mountainous tracts of the countries of the southern parts of

Central Asia, where the lofty mountains of Ararat, Demavend, and Savalan form the chief elevations of the region to which we look as the cradle of our race.

But, to revert to subjects connected with Britain, in no portion of the surface of the Globe have we made such great and rapid advances as in Australia. Doubtless much of this progress in settlement and civilization, particularly in Victoria, is due to the discovery of those enormous masses of gold which are producing powerful effects far and wide. But looking to the work of purely Geographical pioneers, I can declare, that some of the most valuable and daring researches from the earliest days to the present time have been completed, wholly irrespective of profits gained through the attraction of the precious metal. The great discoveries of Sturt, Eyre and Leichhardt were made before the existence of gold was known, and even now, when gold is the most seductive of baits to entice the traveller, see what vast regions the brothers Gregory have laid open in Northern, Eastern and Western Australia without the recompense of a single yellow nugget. Again; look to South Australia, where gold is scarcely known, at least in any appreciable quantity, and see what its inhabitants have done in pushing far into the interior, simply to acquire fresh pasture-lands. In contemplating these recent discoveries we are lost in admiration of what one individual, Mr. McDougall Stewart, has accomplished in so short a time, and we read with astonishment of the privations he underwent to realize the existence of fresh-water streams and oases on the borders of the great interior saline desert.

Still more were we surprized when we learned that this great continent, the rivers of which were so long considered to be useless, has had its one mighty stream, the Murray, rendered navigable for 1,800 miles. With its affluents, the Darling and Murrumbidgee, this river may indeed be said to have been laid open for 2,500 miles, i. e. between fifteen new towns which have sprung up in the interior and the sea—and all this by the clearing away of the stems and stumps of trees, the result of ages of decay.

There are now indeed in England some of the eminent men, whether governors, statesmen, or explorers of this great colonial empire, who will, I hope, before we adjourn, throw fresh light on these recent discoveries.

Presiding as I have for several years over the Royal Geographical Society, and having had to pass in review the progress made by the sons of Britain in different parts of the world, it has ever been to me a source of the sincerest gratification to watch over the rapid strides made by the colonists of Australia, and to observe that they have carried with them all the energy of our race into the land of their adoption. Whilst I traced with deep interest the explorations of their boldest travellers through the bush—and witnessed with delight the working out of that golden wealth, of which perhaps, because I was a Highlander as well as a geologist, I had a sort of *second sight*—whilst I revelled in seeing her ports filled with ships, and abounding in commerce—not all these attributes have rejoiced me more than the knowledge I acquired, that our Australian colonists are truly and sincerely attached to Britain and our Sovereign.

As it is out of my power, without fatiguing you, on the present occasion to advert to all the recent advances in Ethnology, I will now only say, that, besides many communications from other gentlemen, including Mr. Lockhart's excellent notes on China, my eminent and valued friend, Mr. John Craufurd, will give us two memoirs; the one, "On the Relation of the Domesticated Animals to Civilization:" the other, "On the Aryan, or Indo-Germanic Theory:" each of which will, I doubt not, be worthy of the President of the Ethnological Society of London.

Let me now then offer a few general observations on those sciences, to the cultivation of which the business of this Section is devoted. Geography regarded only as the description of the outlines of the Earth, and the determination by astronomical observations of the relative position of hills, rivers, and valleys, to be laid down by the topographer on a map, is but the key-stone of that splendid science when viewed in its most comprehensive bearings. For, of how much of its real value is it deprived if not followed in its train by all the affiliated sciences which relate to the phenomena of our mother Earth. How infinitely is the important basis of our science enriched by the descriptions of the animals and plants which, teeming on the surface of our planet, are distinguished by forms peculiar to each region—such distribution being coincident with relative differences of climate.

Again, I know full well, as a weather-beaten geologist, that the science which I have most cultivated would be void of a foundation, if it did not rest on the principles of physical geography; for half the labours of the geologist consists in restoring, not in imagination but by a positive appeal to facts as registered on tablets of stone, the former outlines of sea and earth at different successive periods, and in marking the various oscillations of land and water as well as the necessary accompaniments of grand meteorological changes.

If therefore the geographer is guided to the relative position of his localities by the lights of astronomy, he also knows that accurate observation of all terrestrial changes is of the highest value in enabling his close ally the geologist to interpret and read off the former conditions of the crust of the earth. For, just as geography in its present phase is necessarily connected with ethnology, so its earliest features as a science can alone be thoroughly comprehended by the geologist. His is the province to bring to the mind's eye the various relations of land and water through the olden periods when most of our present continents were formed beneath the sea, and to trace the successive elevations and depressions which characterized epochs long anterior to the existence of man. Even in those remote times when some lands were elevated and others depressed, the waters and the earth were successively occupied by various animals which lived and died to be succeeded again by other and more highly organized races, until at length a being endowed with reason was created.

And when, having gone through all the long epochs of geological time, we approach the period when man appeared, how interesting is it to endeavour to unravel the changes which our lands underwent from that recent geological date when the British Isles formed part of the terra firma of Europe! Then at a later period, how inciting is it to mark the signs of the commixture of the rudest and earliest works of man with the remains of animals, most of which are now extinct, yet mixed up with others which have lived on to our own day!

Thus, whilst the geological geographer who visits the banks of the Somme, and sees such an assemblage of relics beneath great accumulations formed by water, (as I have recently wit-



nessed myself,) he is compelled to infer, that at the period when such a phenomenon was brought about, the waters which have now diminished to an ordinary and small river, had risen in great inundations to the height of one hundred feet and more above the present stream, and swept over the slopes of the chalk on which the primeval inhabitants were fashioning their rude flint instruments, and when, as I would suggest, they escaped to the adjacent hills, and saving themselves from the sweeping flood, left no traces of their bones in the silt, sand or gravel.

This linking on of geology with human history and these works of primeval art comes legitimately under the consideration of this Section, and here we have just as full right to discuss and test this question, as my dear friends the geologists in their own Section C, the more so as it was to this connection between geology and history that Lord Wrottesley has just called the attention of the Association in his Presidential Address.

Then again, as we descend with the stream of time until we reach reliable records, the geographer next endeavours to throw light on the marches of the great generals of antiquity and the sites of ancient cities; and then truly the geologist, geographer, and ethnologist become united with the antiquary and historian. Taking our recent British example of the discovery of the Uriconium of the Romans at Wroxeter in Shropshire, where is the geographer who has looked at the mounds of earth which till recently covered that ancient city, and is not convinced, that causes arising from the combined destruction by man and natural decay, have produced the mass of overlying matter on the shores of the Severn, which has hidden from our vision one of the famous Roman towns of Britain? On my own part, as I have delighted in tracing the sites of the battles of our great British chief Caractacus, and in unravelling the age of those Silurian rocks in which he made the chief defences of his own kingdom, so I can now bring back to my imagination, how the legions of Ostorius were reinforced from that Uriconium, which has just been disinterred from its earthy covering by the zealous labours of the enlightened antiquary Wright, now a Secretary of this Section.

In this manner we see, that as our inquiries necessarily stimulate us on the one hand to recede to the very earliest traces of

man upon the globe, so, on the other, we are led on into that department of Art and Archæology which connects the present with the past, and are thus enabled to offer to the consideration of our associates and auditors, subjects of prevailing and universal interest—subjects which will, I doubt not, be handled with redoubled zest, now that we are again happily met together for the third time in this very ancient seat of learning.

In conclusion, Ladies and Gentlemen, I have now only to congratulate you on the recent rapid extension of Geographical Science throughout the enlightened classes of our countrymen. Brought up with a profound reverence for the works of God, and a due admiration of the finest efforts of man, those sons of our gracious Sovereign who are of sufficient age to profit by extensive travel, are already proving, that in their spirit of adventure they are true Englishmen. The heir to the crown, after rambles in our Scottish Highlands and travels on the continent, is about to quit this his Alma Mater, and, to the great joy of our colonists, to visit North America, and there rivet still more strongly the link which binds the loyal people of those British provinces to the mother country, whilst Prince Alfred, after cruizing in the Mediterranean, is now sailing across the Southern Atlantic to Bahia, not without having ascended on his way to the very summit of the Peak of Teneriffe. The willing cooperation of the last and present President\* of the Royal Geographical Society demonstrates that our nobility are as much alive to the vast importance of our subject as the middle classes of the community. For my own part, I rejoice to have been able to labour zealously in diffusing geographical knowledge among my countrymen, and I can give you no stronger proof of my satisfaction than by saying, that, as I proposed the establishment of this Section, so my gratification is complete, in seeing that it is now second in popularity and utility to no branch of the British Association.

\* Earl de Grey and Ripon, and Lord Ashburton.

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The Bishop of Oxford in an eloquent speech moved, That the Address be printed; and the motion having been seconded by Admiral FitzRoy was adopted by the Section.







OXFORD, 1860.

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# BRITISH ASSOCIATION

FOR THE

## ADVANCEMENT OF SCIENCE.

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THIRTIETH MEETING, 1860.

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### JOURNAL OF SECTIONAL PROCEEDINGS.

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N<sup>o</sup> 1.

Issued WEDNESDAY Morning, June 27,

AT EIGHT A.M.

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Members who desire to read Memoirs to any Section of the Meeting are requested to forward or deliver the same immediately to the Secretaries of that Section, and to arrange without delay with those Officers, by letter, as to the time and manner of reading the communications. (*See page 8.*)

Letters, Parcels, and other Communications for the General and Sectional Officers and other Members of the Association may be left in the care of the *Clerk at the Post Office, in the Inquiry Room, Radcliffe Library.*

The Secretaries of Sections and other Members should not neglect to apply for Letters.

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#### MEETINGS THIS DAY.

Council, ..... at 10 A.M. ...., Clarendon.

General Committee, at 1 P.M. .... Convocation House.

General Meeting, ... at 4 P.M. .... Sheldonian Theatre.

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JAMES YATES, Esq.

# ORDER OF BUSINESS

IN THE

## SECTIONS AND SECTIONAL COMMITTEES.

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### Constitution of the Sectional Committees.

On Wednesday, June 27, 1860, the President, Vice-Presidents, and Secretaries of each Section having been nominated by the General Committee, these Officers are to complete the Sectional Committees, by selecting individuals from among the Members (not Associates) present at the Meeting, whose assistance they may particularly desire.

The List, when completed as far as possible, is to be entered in the Sectional Minute-Book, and a copy forwarded to the Printer, *Inquiry Room*, Radcliffe Library, who is charged with the printing of the same before Eight A. M. on Thursday, June 28, in the Journal of the Sectional Proceedings, No. 2.

### Order for Reading of Papers.

On Wednesday, June 27, after the Meeting of the General Committee, the Secretaries of Sections are requested to use their utmost efforts to arrange immediately for the reading of Reports and other communications on Thursday, and to forward a list of the papers appointed to be read to the Printer, who is charged with the printing of the same before Eight A. M. on Thursday in the Journal.

On Thursday, June 28, and each subsequent day of the Meeting, the Secretaries are to complete (if it were left imperfect) the list of papers appointed to be read on that day; also, on or before Three P. M. to correct, on a copy of the Journal, the list of papers which have been read on that day, to add to it a list of those appointed to be read on the next day, and to send this copy of the Journal, without delay to the Printer, who is charged with printing the same before Eight A. M. next morning in the Journal.

### Business of the Sectional Committees.

Committee Meetings to be held on Thursday, Friday, Saturday, Monday, and Tuesday, June 28 to July 3 inclusive, from Ten to Eleven punctually, for the objects stated in the Rules of the Association, and specified as after.

The Business is to be conducted in the following manner:—

The Secretary will read the Minutes of last year's proceedings, as recorded in the Minute-Book, which will be furnished to him; or, in default of such record having been entered, the Synopsis of Recom-



mendations adopted at the last Meeting, and printed in the last volume of Transactions. He will read letters from, or will call upon Members to whom, at the last Meeting, particular reports or researches were intrusted, for a statement of the progress they have made, and will inform the Committee in what degree the communications offered to the Section at this Meeting appear to supply desiderata noticed at former Meetings.

The Committee will take into consideration any suggestions which may be offered by their Members for the advancement of Science; they are specially requested to review the recommendations adopted at preceding Meetings, as published in the volumes of the Association, and the communications made to the Sections at this Meeting, for the purpose of selecting definite points of research, to which individual or combined exertion may be usefully directed, and branches of knowledge on the state and progress of which reports are wanted; to name individuals or Committees for the execution of such reports or researches; and to state whether, and to what degree, these objects may be usefully advanced by the appropriation of the funds of the Association, by application to Government, Philosophical Institutions, or Local Authorities.

In case of appointment of Committees for special objects of Science, it is expedient that *all the Members of the Committee should be named, and one of them appointed to act as Secretary, for insuring attention to business.*

Committees have power to add to their number persons whose assistance they may require.

### Grants of Money, &c.

Grants of pecuniary aid for Scientific purposes made at any former Meeting of the Association *expire at this Meeting*, unless a continuance of them be ordered by the General Committee.

In each Committee, the Member first named is the person entitled to call on the Treasurer, John Taylor, Esq., 6, Queen-street Place, Upper Thames-street, London, E.C., for such portion of the sum granted as may, from time to time, be required, according to a regular form, which will be supplied.

In grants of money to Committees, the Association does not contemplate the payment of personal expenses to the Members. Committees and individuals, to whom grants of money for scientific purposes have been intrusted, are required to present, to each following Meeting of the Association, a report of the progress which has been made, and a statement of the sums which have been expended, and the balance which remains on each grant.

### Instruments, &c.

All instruments, papers, drawings, and other property of the Association, are to be returned to the Assistant-General Secretary, Oxford, when not employed in carrying on scientific inquiries.

## SECTION G.—Mechanical Science.

1. Interim Report on the gauging of Water.
2. Report of the Committee on Steam-ship Performance.
3. *Admiral Moorsom*.—On the Performance of Steam Vessels.
4. *P. W. Barlow, F.R.S.*—On the Mechanical effects of combining suspension chains and girders, and the value of the practical application of this system, (illustrated by a Model).
5. *Callcott Reilly*.—On the longitudinal stress of the plate girder.
6. *W. Hall*.—On the manufacture of Submarine Cables, (illustrated by a Model and Specimens).
7. *C. W. Siemens*.—On a new process of covering Submarine Conductors with India Rubber or Compounds of India Rubber.

## OFFICERS AND COMMITTEES

OF THE

### SEVERAL SECTIONS.

#### SECTION A.—Mathematical and Physical Science. (*Convocation House*.)

*President*.—Rev. B. Price, M.A., F.R.S., Prof. of Natural Philosophy, Oxford.

*Vice-Presidents*.—Sir D. Brewster, R.H., D.C.L., F.R.S.; Dr. Lloyd; R. Main, Esq.; Master of Trinity College, Cambridge.

*Secretaries*.—Prof. Stevelly, LL.D.; Rev. T. Rennison, M.A., Fellow of Queen's Coll.; Rev. G. C. Bell, M.A., Fellow of Worcester Coll.

*Committee*.—The Astronomer Royal; Professor Adams; J. B. Bateman; W. R. Birt; Professor Boole; Rev. Dr. Booth; Sir D. Brewster; J. A. Broun; A. Cayley; Professor Draper; Rev. S. Earnshaw; Admiral Fitzroy; J. P. Gassiot; J. H. Gladstone; Sir W. Snow Harris; Professor Hennessy; Rev. Dr. Hincks; Col. R. E. James; W. Lascelles; Dr. Lee; Rev. Dr. Lloyd; Rev. Canon Moseley; The Master of Trinity College, Cambridge; James Nasmyth; Professor Phillips; General Portlock; Professor Rankine; Rev. George Salmon; H. J. S. Smith; J. Sprague; Professor Stokes; G. J. Stoney; Professor Struve; J. Sylvester; Professor Tyndall; Rev. B. Walker; Professor Wheatstone; Professor Willis; Lord Wrottesley.

#### SECTION B.—Chemical Science. (*Museum*.)

*President*.—B. C. Brodie, Esq., M.A., F.R.S., Professor of Chemistry, Oxford.

*Vice-Presidents*.—Dr. Andrews, M.D.; Warren De La Rue, Esq., Ph. D., F.R.S.; Professor Faraday, D.C.L., F.R.S., F.G.S.; Professor Frankland, Ph. D., F.R.S.; Professor Hoffman, Ph. D., F.R.S.; Dr. Miller, M.D., F.R.S.

*Secretaries*.—Prof. H. E. Roscoe; G. D. Liveing, M.A., F.C.S.; A. Vernon Harcourt, Esq., B.A., F.C.S., Student of Ch. Ch.; A. B. Northcote, Esq., F.C.S., Queen's Coll.

*Committee*.— [Not yet formed.]

SECTION C.—Geology. (*Museum*.)

*President*.—Rev. A. Sedgwick, M.A., F.R.S., Prof. of Geology, Cambridge.

*Vice-Presidents*.—Sir Charles Lyell, F.R.S.; L. Horner, F.R.S.; Major-General Portlock, R.E., F.R.S.

*Secretaries*.—Prof. Harkness, F.R.S.; Capt. Woodall, M.A., F.G.S., Oriol College; Edward Hull, F.G.S.

*Committee*.—Rev. Dr. Anderson, F.G.S.; Dr. Falconer, F.R.S.; R. Hutton, F.R.S.; Professor Huxley, F.R.S.; Sir Roderick I. Murchison, G.C.St.S., F.R.S.; O. Moore, F.G.S.; Professor Owen, F.R.S.; W. Pengelly, F.G.S.; Rev. W. S. Symonds, F.G.S.; Rev. W. W. Wood, F.G.S.; E. Wood, F.G.S.; Dr. Wright, F.G.S.

SECTION D.—Zoology and Botany, including Physiology. (*Museum*)

*President*.—Charles G. B. Daubeny, M.D., F.R.S., Professor of Botany, Oxford.

*Vice-Presidents*.—Professor Bell; Dr. Daubeny, G.B., M.D., LL.D.; Sir W. Jardine, Bart., F.R.S.E.; Rev. L. Jenyns; Professor Owen, M.D., LL.D., F.R.S.

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*President*.—Professor Rolleston, M.D.

*Vice-Presidents*.—Dr. Davy, F.R.S.; Geo. Rusk, F.R.S.

*Secretaries*.—Robert Macdonnell, M.D., M.R.I.A.; Edward Smith, M.D., LL.B., F.R.S.

*Committee*.—Prof. Beale, M.D., F.R.S.; Dr. Bennett; Prof. Cavus; Dr. Gibb; John Lubbock, F.R.S.; Dr. Lewis; Dr. Brown Leguard, F.R.S.; Prof. Macdonald, M.D.; Prof. Ogilvie; M. Ollier; D. C. B. Radcliffe.

SECTION E.—Geography and Ethnology. (*Divinity School*)

*President*.—Sir R. I. Murchison, G.C.St.S., D.C.L., F.R.S., V.P.R.G.S., Director General of The Geological Survey of the United Kingdom.

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*Meetings of the British Association for the Advancement of Science, Oxford, June, 1860.*

**HOURS AND PURPOSES OF MEETING, Wednesday, June 27, to Wednesday, July 4.**

DATE.	COUNCIL. (Clarendon.)	GENERAL COMMITTEE. (Convocation House.)	COMMITTEE OF RECOMMEN- DATIONS. (Clarendon.)	COMMITTEES OF SECTIONS.	SECTIONS.	GENERAL MEETINGS. (Theatre.)	SOIREES, &c. (Museum.)
Wednesday, 27th June	10 A.M.	{ * 1 P.M. To receive Report of Council. }	.....	.....	.....	{ 4 P.M. The Presi- dent's Address. }	.....
Thursday.. 28th "	.....	.....	.....	10 A.M.	11 A.M.	.....	{ Soirée, with Ex- periments. 8½ P.M. }
Friday ... 29th "	.....	.....	3 P.M.	10 A.M.	11 A.M.	{ 4 P.M. Prof. Wal- ker's Discourse. }	{ Soirée, with Ex- periments. 8½ P.M. }
Saturday .. 30th "	.....	.....	.....	10 A.M.	11 A.M.	.....	.....
Sunday ... 1st July							
Monday.... 2nd "	.....	{ 3 P.M. To fix the next place of Meeting. }	.....	10 A.M.	11 A.M.	{ 2 P.M. D.C.L. con- ferred. }	{ Soirée, with Ex- periments. 8½ P.M. }
Tuesday ... 3rd "	.....	.....	3 P.M.	10 A.M.	11 A.M.	.....	{ Soirée, with Mi- croscopes. 8½ P.M. }
Wednesday . 4th "	.....	{ 1 P.M. To receive Report of Com- mittee of Re- commendations. }	10 A.M.	.....	.....	{ 3 P.M. Concluding Meeting. }	.....

**N.B.** Excursions are proposed for Thursday, July 5, of which separate notices will be prepared.

\* At this Meeting the List of Sectional Officers will be completed.

*Presidents and Secretaries of Sections to be proposed to  
the General Committee on Wednesday, June 27.*

**SECTION A.—Mathematical and Physical Science.**

*President*, .. REV. B. PRICE, M.A., F.R.S., Prof. of Natural Philosophy, Oxford.  
*Secretaries*, . PROF. STEVELLY, LL.D.; REV. T. RENNISON, M.A., Fellow of Queen's Coll.; REV. G. C. BELL, M.A., Fellow of Worcester Coll.

**SECTION B.—Chemical Science.**

*President*, .. B. C. BRODIE, Esq., M.A., F.R.S., Professor of Chemistry, Oxford.  
*Secretaries*, . PROF. H. R. ROSCOE; G. D. LIVING, M.A., F.C.S.; A. VERNON HARCOURT, Esq., B.A., F.C.S., Student of Christ Church; A. B. NORTHCOTE, Esq., F.C.S., Queen's Coll.

**SECTION C.—Geology.**

*President*, .. REV. A. SEDGWICK, M.A., F.R.S., Prof. of Geology, Cambridge.  
*Secretaries*, . PROF. HARKNESS, F.R.S.; CAPT. WOODALL, M.A., F.G.S., Oriel College; EDWARD HULL, Esq., F.G.S.

**SECTION D.—Zoology and Botany, including Physiology.**

*President*, .. CHARLES G. B. DAUBENY, M.D., F.R.S., Prof. of Botany, Oxford.  
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[A Subsection of Physiology will be proposed in the General Committee.]

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*President*, .. SIR R. I. MURCHISON, G.C.St.S., D.C.L., F.R.S., Director of the Geological Survey of the United Kingdom.  
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**SECTION F.—Economic Science and Statistics.**

*President*, .. NASSAU W. SENIOR, Esq., M.A., late Professor of Political Economy, Oxford.  
*Secretary*, .. REV. J. E. T. ROGERS, M.A., Magdalen Hall, Tookian Professor of Political Economy, King's College, London; EDMUND MACROBY, Esq., M.A.

**SECTION G.—Mechanical Science.**

*President*, .. W. J. MACQUORN RANKINE, Esq., M.A., LL.D., F.R.S., Professor of Engineering, Glasgow.  
*Secretary*, .. HENRY WRIGHT, Esq.; P. LE NEVE FORSTER, Esq.; REV. F. HARRISON, M.A., Fellow of Oriel College,

OXFORD, 1860.

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# BRITISH ASSOCIATION

FOR THE

## ADVANCEMENT OF SCIENCE

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THIRTIETH MEETING, 1860.

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### JOURNAL OF SECTIONAL PROCEEDINGS.

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N<sup>o</sup> 2.

Issued THURSDAY Morning, June 28,

AT EIGHT A.M.

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Members who desire to read Memoirs to any Section of the Meeting are requested to forward or deliver the same immediately to the Secretaries of that Section, and to arrange without delay with those Officers, by letter, as to the time and manner of reading the communications. (*See page 8.*)

Letters, Parcels, and other Communications for the General and Sectional Officers and other Members of the Association may be left in the care of the *Clerk at the Post Office, in the Inquiry Room, Radcliffe Library.*

The Secretaries of Sections and other Members should not neglect to apply for Letters.

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#### MEETINGS THIS DAY.

Committees of Sections, at 10 A.M.

Sections, ..... at 11 A.M.

Soirée, &c. .... at 8½ P.M. .... Museum.

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## PAPERS READ

On THURSDAY, June 28.

### SECTION A.—Mathematical and Physical Science.

The President of the Section briefly addressed it on taking the Chair.

1. *By the late Professor Baden Powell.*—Report on Observations of Luminous Meteors, 1859–60. Prepared by James Glaisher, Esq., F.R.S. With Observations on luminous Meteors by R. P. Greg; and on the luminous tails of Meteors by M. Schmidt.
2. *J. A. Broun.*—On the Velocity of Earthquake-shocks in the Laterite of India.
3. *J. A. Broun.*—On the Magnetism of Certain Indian Granites.
4. *Patrick Cody.*—On the Trisection of an Angle by Plane Geometry.
5. *Mr. Claudet.*—On the Principles of the Solar Camera.
6. *Mr. Claudet.*—On the Means of Increasing the Angle of Binocular Instruments, in order to obtain a stereoscopic effect in proportion to their magnifying power.
7. *Rev. T. Rankin.*—On Meteorological Observations for 1859, made at Huggate, East Riding, Yorkshire.
8. *Rev. T. Rankin.*—On the Different Motions of Electric Fluid.

### SECTION B.—Chemical Science.

1. *Mr. Symons* exhibited some forms of Alkalimeters suggested by Mr. Wiers.
2. *J. J. Coleman.*—On some Remarkable Relations Existing Between the Atomic Weights, Atomic Volumes, and Properties of the Chemical Elements.
3. *Dr. Bird.*—On the Deodorization of Sewage.

### SECTION C.—Geology.

1. Opening Address by the President.
2. *Professor Phillips.*—On the Geology of the Vicinity of Oxford.
3. *J. F. Whiteaves, Esq., F.G.S.*—On the Invertebrate Fauna of the Lower Oolites of Oxfordshire.
4. *Edmund Hull, Esq., F.G.S.*—On the Blenheim Iron Ore, and the thickness of the formations below the Great Oolite at Stonesfield.
5. *Rev. P. B. Brodie, F.G.S.*—On the Stratigraphical position of certain species of Coral in the Lias.
6. *Rev. H. B. Tristram.*—On the Geological characters of the Sahara.
7. *Rev. J. B. P. Dennis, F.G.S.*—On the mode of flight of the Pterodactyles of the Coprolite bed near Cambridge.

### SECTION D.—Zoology and Botany, including Physiology.

1. *George Ogilvie, M.D.*—Report on Dredging North and East Coast of Scotland.
2. *Rev. P. P. Carpenter.*—On the present state of Natural History in the United States of America.
3. *Professor Daubeny.*—Remarks on the Final Causes of the Sexuality of Plants; with particular reference to Mr. Darwin's work, "On the Origin of Species by Natural Selection."
4. *Professor J. Ray Greene.*—Report on British Medusidæ.

### SUB-SECTION D.—Physiology.

1. The President's Address.
2. *Prof. Carus*.—On Leptocephalidæ, their Anatomy and Systematic Position.
3. *Dr. Edward Smith, F.R.S.*—The action of tea and alcohol contrasted.
4. *Sir Charles Grey*.—On Asiatic Cholera.
5. *M. Garner, F.R.S.*—On the function of the Spinal Cord and its Morbid Changes.

### SECTION E.—Geography and Ethnology.

1. *The President*.—Sir R. Murchison's Address.
2. *Captain Sherrard Osborn, R.N., F.R.G.S.*—On the formation of Oceanic Ice in the Arctic regions.
3. *Captain Parker Snow*.—On the lost Polar Expedition and possible recovery of its scientific documents.
4. *John Crawford, Esq., Pres. Ethn. Soc.*—On the influence of Domestic animals on the progress of Civilization (*Birds*).

### SECTION F.—Economic Science and Statistics.

1. *The President*.—Opening Address.
2. *Frederick Purdy*.—On the Systems of Poor Law Medical Relief.
3. *Edwin Chadwick, C.B.*—On the Physiological as well as Psychological Limit to Mental Labour.

### SECTION G.—Mechanical Science.

1. *Prof. James Thomson of Belfast*.—Interim Report on the gauging of Water.
2. Report of the Committee on Steam-ship Performance.
3. *Admiral Moorsom*.—On the Performance of Steam Vessels.
4. *P. W. Barlow, F.R.S.*—On the Mechanical effects of combining suspension chains and girders, and the value of the practical application of this system, (illustrated by a Model).

## PAPERS TO BE READ

### On FRIDAY, June 29.

#### SECTION A.—Mathematical and Physical Science.

1. *Admiral Fitzroy*.—On British Storms, with large diagrams.
2. *M. Hermann Von Schlagintweit*.—General abstract of the results of Messrs. de Schlagintweit's magnetic survey of India, with three charts.
3. *Mr. du Boulay*.—Observations on the meteorological phenomena of the vernal equinoctial week.
4. *Sir D. Brewster*.—On some optical illusions connected with the inversion of perspective.
5. *Dr. Gladstone*.—On the chromatic properties of the electric light of mercury.
6. *Dr. Gladstone*.—On his own perception of colours.
7. *Mr. Ball*.—Communication of meteorological observations by Alpine travellers.
8. *Rev. S. Earnshaw*.—On the velocity of the sound of thunder.
9. *Dr. Booth*.—On the relations between hyperconics and elliptic integrals.
10. *Mr. J. A. Broun*.—On a magnetic survey of the west coast of India.
11. *Mr. J. A. Broun*.—On a new induction dip circle.
12. *Mr. W. R. Birt*.—On the forms of certain lunar craters indicative of a peculiar degrading force, with diagrams.
13. *Henry Draper, M.D.*—On a reflecting telescope for celestial photography, now erecting at Hastings, near New York, communicated by Professor Draper.



### SECTION B.—Chemical Science.

1. *W. R. Grove*.—Or the transmission of Electrolysis across Glass.
2. *Warren De La Rue*, and *Dr. Hugo Müller*.—On the Isomers of Cumole.
3. *Warren De La Rue*, and *Dr. Hugo Müller*.—On a new Acetic Ether occurring in a natural resin.
4. *Dr. Frankland*.—On a new Organic Compound containing Boron.
5. *Dr. W. A. Miller*.—On the Atomic Weight of Oxygen.
6. *Professor Rowney*.—On the analysis of some Connemara minerals.
7. *Professor Rowney*.—On the composition of Jet.
8. *Professor Voelcker*.—On the occurrence of poisonous metals in Cheese.
9. *T. Scoffern*.—On waterproof and unalterable small-arm Cartridges.
10. *Dr. Hermann Sprengel*.—On a new form of blowpipe for laboratory use.

### SECTION C.—Geology.

1. *Dr. Dawbeny*.—Remarks on the Elevation Theory of Volcanos.
2. *T. Sterry Hunt, Esq.*—Notes on some points in Chemical Geology.
3. *W. Pengelly, Esq.*—On the Geographical and Chronological distribution of Devonian fossils in Devon and Cornwall.
4. *Dr. Wright*.—On the *Avicula contorta* bed, and Lower Lias in the South of England.
5. *Joseph Prestwich*.—On some new facts in relation to the section of the cliff at Mundesley, Norfolk.
6. *Dr. Geinitz*.—On Snow Crystals observed at Dresden.
7. ———.—On the Silurian Formation in the district of Wilsdruff.
8. *Prof. Harkness*.—On the Metamorphic Rocks of the North of Ireland.
9. *Capt. Woodall*.—On the Intermittent Springs of the Chalk and Oolite of the neighbourhood of Scarborough.

### SECTION D.—Zoology and Botany.

1. *Professor Backman*.—Report on Experiments on the Alteration of the Specific Forms of Plants by Culture.
2. *Rev. H. H. Higgins*.—On some Specimens from the Pathological Collection of Shells by the late Dr. Gaskoigne.
3. *J. Gwyn Jeffreys, F.R.S.*—Exhibition of Opercular Monstrosities of *Buccinum nudatum*.
4. *R. Dowden (R.)*.—On a Plant poisoning a Plant.
5. *Dr. C. Dresser*.—On Abnormal forms of *Passiflora Cærulea*.
6. *G. Ogilvie, M.D.*—On the Hard Tissues of Fern Stems.
7. *J. Gwyn Jeffreys, F.R.S.*—On the British *Teredines* or Ship-worms.
8. *Professor Vander Hoeven*.—Some Observations on the *Teredo Navalis*, and the mischief caused by it in Holland.
9. *Dr. E. Perceval Wright*.—Exhibition of a Fresh water *Teredo*.

### SUB-SECTION D.—Physiology.

1. *Dr. Lewis*.—On a Hydro-spirometer.
2. *John Lubbock, Esq., F.R.S.*—On the Development of Buccinum.
3. *Dr. Michael Foster*.—Contributions to the Theory of Cardiac Inhibition.
4. *Prof. Huxley, F.R.S.*—On the Development of Pyrosoma.
5. *Prof. Beale, F.R.S.*—On the Ultimate Arrangement of Nerves in Muscular Tissue.
6. *Dr. C. Kidd*.—On the Nature of Death by Chloroform.
7. *Dr. E. R. Harvey, M.A., M.B.*—An Experimental Inquiry into the Mode of Death produced by Aconite.

### SECTION E.—Geography and Ethnology.

1. *Dr. D. Livingstone*.—Latest Discoveries in South-Central Africa.
2. *Mr. Consul Petherick, of Khartum in Upper Egypt*.—On his proposed Journey from that place to meet Capt. Speke, on or near the Lake Nyanza of Central Africa.
3. *Mr. T. Wright*.—On the Excavations on the site of the Roman city of Uriconium, at Wroxeter.

4. *Mr. W. Lockhart*.—On the Mountain Districts of China, and their Aboriginal inhabitants.
5. *Dr. Macgowan, U.S.*—History of the *Ante* Christian Settlement of the Jews in China.
6. *Dr. Hincks*.—On some Ethnological Boulders and their probable origin.
7. *Mr. Richard Cull*.—On the Existence of a true plural of a personal pronoun in a living European language.
8. *D. J. May, R.N.*—Latest Travels on the Niger and through Yoruba.

#### SECTION F.—Economic Science and Statistics.

1. *Henry Fawcett, M.A., F. Trinity Hall, Cambridge*.—Dr. Whewell on the Method of Political Economy.
2. *Rev. James Booth, LL.D., F.R.S.*—On the true principles of an Income Tax.
3. *William Newmarch, Esq.*—On some suggested Schemes of Taxation and the difficulties of them.
4. *Henry Roberts, F.S.A.*—Notes on various efforts to improve the Domiciliary Condition of the Labouring Classes.
5. *Dr. Michelsen*.—Serf-dom in Russia.

#### SECTION G.—Mechanical Science.

1. *Mr. Barlow's* Paper on combining Suspension Chains and Girders will be discussed.
2. *Calcott Reilly*.—On the Longitudinal stress of the Plate Girder.
3. *William Hall*.—On the Manufacture of Submarine Cables (illustrated by a Model and Specimens.)
4. *C. W. Siemens*.—On a new process of covering Submarine Conductors with India rubber or Compounds of India rubber.
5. *William Simons*.—On Improvements in Ship-building.
6. *Earl of Callhness*.—On Road Locomotives.
7. *J. Elder*.—On a Cylindrical Spiral Boiler.
8. *E. A. Cowper*.—On a new mode of obtaining Blast of very high temperature in the Manufacture of Iron.
9. *Capt. Blakely, R.A.*—On Artillery.
10. *B. W. Richardson, M.A., M.D.*—Suggestions for an Electro-Magnetic Railway break.

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### SEVERAL SECTIONS.

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*Meetings of the British Association for the Advancement of Science, Oxford, June, 1860.*

**HOURS AND PURPOSES OF MEETING, Wednesday, June 27, to Wednesday, July 4.**

DAYS.	COUNCIL. (Clarendon).	GENERAL COMMITTEE. (Convocation House).	COMMITTEE OF RECOMMEN- DATIONS. (Clarendon).	COMMITTEES OF SECTIONS.	SECTIONS.	GENERAL MEETINGS. (Theatre.)	SOIREES, &c. (Museum.)
Wednesday, 27th June	10 A.M.	{ 1 P.M. To receive Report of Council.	.....	.....	.....	{ 4 P.M. The Presi- dent's Address.	.....
Thursday.. 28th "	.....	.....	.....	10 A.M.	11 A.M.	.....	{ Soirée, with Ex- periments, 8½ P.M.
Friday... 29th "	.....	.....	3 P.M.	10 A.M.	11 A.M.	{ 4 P.M. Prof. Wal- ker's Discourse.	{ Soirée, with Ex- periments, 8½ P.M.
Saturday.. 30th "	.....	.....	.....	10 A.M.	11 A.M.	.....	.....
Sunday... 1st July							
Monday.... 2nd "	.....	{ 3 P.M. To fix the next place of Meeting.	.....	10 A.M.	11 A.M.	{ 2 P.M. D.C.L. con- ferred. { 4 P.M. Capt. She- ppard Osborn's Dis- course.	{ Soirée, with Ex- periments, 8½ P.M.
Tuesday... 3rd "	.....	.....	3 P.M.	10 A.M.	11 A.M.	.....	{ Soirée, with Mi- croscopes, 8½ P.M.
Wednesday. 4th "	.....	{ 1 P.M. To receive Report of Com- mittee of Re- commendations.	10 A.M.	.....	.....	{ 3 P.M. Concluding Meeting.	.....

N.B. Excursions are proposed for Thursday, July 6, of which separate notices will be prepared.

\* At this Meeting the List of Sectional Officers will be completed.

OXFORD, 1860.

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# BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.

---

THIRTIETH MEETING, 1860.

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JOURNAL OF SECTIONAL PROCEEDINGS.

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N<sup>o</sup> 4.

Issued SATURDAY Morning, June 30,  
AT EIGHT A.M.

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Members who desire to read Memoirs to any Section of the Meeting are requested to forward or deliver the same immediately to the Secretaries of that Section, and to arrange without delay with those Officers, by letter, as to the time and manner of reading the communications.

Letters, Parcels, and other Communications for the General and Sectional Officers and other Members of the Association may be left in the care of the *Clerk at the Post Office, in the Inquiry Room, Radcliffe Library.*

The Secretaries of Sections and other Members should not neglect to apply for Letters.

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## MEETINGS THIS DAY.

Committees of Sections, at 10 A.M.

Sections, ..... at 11 A.M.

Shotover Party meets near the Windmill, at 4 p. m.

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Any Members of the Association who are willing to exhibit Microscopes or other Instruments on *Tuesday* Evening, and have not yet signified their wish to do so, are requested to communicate with Dr. Acland without delay.

Printed, under the Superintendence of the ASSISTANT-GENERAL SECRETARY,  
by JAMES WRIGHT, Printer to the University.

## PAPERS READ

On **FRIDAY, June 30.**

### SECTION A.—Mathematical and Physical Science.

1. *Admiral Fitzroy*.—On British Storms, with large diagrams.
2. *M. Hermann Von Schlagintweit*.—General abstract of the results of Messrs. de Schlagintweit's magnetic survey of India, with three charts.
3. *Mr. J. A. Broun*.—On a magnetic survey of the west coast of India.
4. *Mr. du Boulay*.—Observations on the meteorological phenomena of the vernal equinoctial week.
5. *Sir D. Brewster*.—On some optical illusions connected with the inversion of perspective.
6. *Dr. Gladstone*.—On the chromatic properties of the electric light of mercury.
7. *Dr. Gladstone*.—On his own perception of colours.
8. *Mr. Ball*.—Communication of meteorological observations by Alpine travellers.
9. *Rev. S. Earnshaw*.—On the velocity of the sound of thunder.

### SECTION B.—Chemical Science.

1. *Dr. Frankland and Mr. Duppa*.—On a new Organic Compound containing Boron.
2. *Professor Rowney*.—On the analysis of some Connemara minerals.
3. *W. R. Grove*.—On the transmission of Electrolysis across Glass.
4. *Professor Rowney*.—On the composition of Jet.
5. *Dr. Hermann Sprengel*.—On a new form of blowpipe for laboratory use.
6. *Professor Voelcker*.—On the occurrence of poisonous metals in Cheese.
7. *T. Scoffern*.—On waterproof and unalterable small-arm Cartridges.
8. *Warren De La Rue, and Dr. Hugo Müller*.—On the Isomers of Cumol.
9. *Warren De La Rue, and Dr. Hugo Müller*.—On a new Acetic Ether occurring in a natural resin.
10. *Dr. W. A. Miller*.—On the Atomic Weight of Oxygen.

### SECTION C.—Geology.

1. *Dr. Daubeny*.—Remarks on the Elevation Theory of Volcanos.
2. *T. Sterry Hunt, Esq.*—Notes on some points in Chemical Geology.
3. *W. Pengelly, Esq.*—On the Geographical and Chronological distribution of Devonian fossils in Devon and Cornwall.
4. *Dr. Wright*.—On the *Avicula contorta* bed, and Lower Lias in the South of England.
5. *Joseph Prestwich*.—On some new facts in relation to the section of the cliff at Mundesley, Norfolk.

### SECTION D.—Zoology and Botany.

1. *Professor Buckman*.—Report on Experiments on the Alteration of the Specific Forms of Plants by Culture.
2. *Rev. H. H. Higgins*.—On some Specimens from the Pathological Collection of Shells by the late Mr. Gaskoin.
3. *J. Gwyn Jeffreys, F.R.S.*—Exhibition of Opercular Monstrosities of *Buccinum undatum*.
4. *R. Dowden (R.)*.—On a Plant poisoning a Plant.
5. *Dr. C. Dresser*.—On Abnormal forms of *Passiflora cærulea*.
6. *G. Ogilvie, M.D.*—On the Hard Tissues of Fern Stems.
7. *J. Gwyn Jeffreys, F.R.S.*—On the British *Teredines* or Ship-worms.
8. *Professor Van der Hoeven*.—Some Observations on the *Teredo navalis*, and the mischief caused by it in Holland.
9. *Dr. E. Perceval Wright*.—Exhibition of a Fresh water *Teredo*.

### SUB-SECTION D.—Physiology,

1. *Dr. Lewis*.—On a Hydro-spirometer.
2. *John Lubbock, Esq., F.R.S.*—On the Development of *Buccinum*.
3. *Dr. Michael Foster*.—Contributions to the Theory of Cardiac Inhibition.

4. *Prof. Huxley, F.R.S.*—On the Development of Pyrosoma.
5. *Prof. Beale, F.R.S.*—On the Ultimate Arrangement of Nerves in Muscular Tissue.
6. *Dr. C. Kidd.*—On the Nature of Death by Chloroform.
7. *Dr. E. R. Harvey, M.A., M.B.*—An Experimental Inquiry into the Mode of Death produced by Aconite.

#### SECTION E.—Geography and Ethnology.

1. *Dr. D. Livingstone.*—Latest Discoveries in South-Central Africa.
2. *Mr. Consul Petherick, of Khartum in Upper Egypt.*—On his proposed Journey from that place to meet Capt. Speke, on or near the Lake Nyanza of Central Africa.
3. *Mr. T. Wright.*—On the Excavations on the site of the Roman city of Uriconium, at Wroxeter.
4. *Mr. W. Lockhart.*—On the Mountain Districts of China, and their Aboriginal inhabitants.
5. *Dr. Macgowan, U.S.*—History of the Ante Christian Settlement of the Jews in China.

#### SECTION F.—Economic Science and Statistics.

1. *Henry Fawcett, M.A., F. Trinity Hall, Cambridge.*—Dr. Whewell on the Method of Political Economy.
2. *Rev. James Booth, LL.D., F.R.S.*—On the true principles of an Income Tax.
3. *Henry Roberts, F.S.A.*—Notes on various efforts to improve the Domiciliary Condition of the Labouring Classes.

#### SECTION G.—Mechanical Science.

1. *Mr. Barlow's* Paper on combining Suspension Chains and Girders was discussed.
2. *Callcott Reilly.*—On the Longitudinal stress of the Plate Girder.
3. *Walter Hall.*—On the Manufacture of Submarine Cables (illustrated by a Model and Specimens.)
4. *Werner and C. W. Siemens.*—On a new process of covering Submarine Conductors with India rubber or its Compounds.
5. *William Simons.*—On Improvements in Shipbuilding.
6. *The Earl of Cathness.*—On Road Locomotives.
7. *J. Elder.*—On a Cylindrical Spiral Boiler.

### PAPERS TO BE READ

On SATURDAY, June 29.

#### SECTION A.—Mathematical and Physical Science.

1. *Professor W. Thomson.*—Report of Committee appointed to prepare a self-recording atmospheric electrometer for Kew, and portable apparatus for obtaining atmospheric electricity.
2. *E. Vivian, M.A.*—Results of self-registering Hygrometers.
3. *Dr. Booth.*—On the relations between hyperconics and elliptic integrals.
4. *Mr. J. A. Broun.*—On a new induction dip circle.
5. *Henry Draper, M.D.*—On a reflecting telescope for celestial photography, now erecting at Hastings, near New York, communicated by Professor Draper.
6. *Mr. W. R. Birt.*—On the forms of certain lunar craters indicative of a peculiar degrading force, with diagrams.
7. *Mr. W. R. Birt.*—On atmospheric waves, with diagrams.
8. *Sir D. Brewster.*—On microscopic vision and a new form of microscope.
9. *Canon Moseley.*—On the motion of glaciers.



10. *Professor Maxwell*.—On an instrument for exhibiting any mixture of the colours of spectrum.
11. *Mr. A. Cayley*.—On curves of the fourth order having three double points.
12. *C. W. Siemens*.—On a bathometer, or instrument to indicate the depth of the ocean as well as the elevation above the sea by simple reading.
13. *C. W. Siemens*.—Outline of the principles and practice involved in dealing with the electrical conditions of submarine electric telegraphs.
14. *Professor W. B. Rogers, Boston*.—Experiments and conclusions on binocular vision, and some experiments on some of the phenomena of electrical vacuum tubes.
15. *B. Stewart*.—On the light radiated by heated bodies.
16. *J. S. Glennie*.—On physics as a branch of the science of motion.

#### SECTION B.—Chemical Science.

1. *Dr. Gladstone*.—Chemical notes on (1) Creasote; (2) a compound of Molybdenum, Chlorine, and Fluorine; (3) the diffusion of salts in solution as bearing evidence of their reciprocal decomposition.
2. *Mr. Buckton*.—On some reaction of Zinc-ethyl.
3. *Dr. Von Bose*.—Remarks on the Volumetric Theory.
4. *Dr. Lyon Playfair*.—On the representation of neutral Salts on the type of a neutral peroxide  $\text{H}_2\text{O}_2$  instead of a basic oxide  $\text{H}_2\text{O}_2$ .

#### SECTION C.—Geology.

1. *Sir R. I. Murchison*.—To exhibit the New Geological Map of Oxford.
2. *Dr. Geinitz*.—On Snow Crystals observed at Dresden.
3. ———.—On the Silurian Formation in the district of Wilsdruff.
4. *Prof. Harkness*.—On the Metamorphic Rocks of the North of Ireland.
5. *Capt. Woodall*.—On the Intermittent Springs of the Chalk and Oolite of the neighbourhood of Scarborough.
6. *Dr. Anderson*.—Report on the Dura Den excavations.
7. *M. A. Favre*.—On Circular Chains in the Alps.
8. *Professor Jukes*.—On the Igneous Rocks interstratified with the Carboniferous Limestone of the Basin of Limerick.
9. *Rev. P. B. Brodie*.—On the Stratigraphical position of certain species of Corals in the Lias.
10. *C. Moore*.—On the contents of three square yards of Triassic Drift.
11. *Rev. S. R. Smith*.—On the Osseous Bone Caves of Tenby.
12. *Baron Francesco Anca*.—On two newly discovered Ossiferous Caves in Sicily containing Marked Flints, &c.
13. *Rev. W. Lister*.—On some Reptilian foot-prints from the New Red Sandstone North of Wolverhampton.

#### SECTION D.

Papers Read on Thursday and Omitted in Yesterday's Journal.

1. *John Hogg, F.R.S.*—On the distinctions between Plants and Animals;—and on a Fourth Kingdom of Nature.
2. *J. O. Westwood, M.A.*—On a Lepidopterous Parasite on *Fulgora caudalaria*.

#### SECTION D.—Zoology and Botany, including Physiology.

*The Section will meet in the Library.*

1. *Dr. Kinahan, F.L.S.*—Report on dredging in Dublin Bay.
2. *J. O. Westwood, M.A.*—On an Insect heretofore referred to three different orders.
3. *R. Mac Andrew, F.R.S.*—Report of the General Dredging Committee.
4. *Dr. C. Collingwood*.—On recurrent animal Form and its influence on systematic Zoology.
5. *Rev. F. O. Morris, B.A.*—On the permanence of species.

6. *Professor Draper, M.D., New York.*—On the intellectual development of Europe, considered with reference to the views of Mr. Darwin and others, that the progression of Organisms is determined by law.
- The latter three papers will be read about Twelve o'Clock. Sub-Section D will adjourn at this hour in order to take part in the Discussion.

### SUB-SECTION D.—Physiology.

1. *Dr. Gibb.*—On Saccharine formation in the Breast.
2. *Archibald MacLaren, Esq.*—On the influence of Systematized Exercise on the Expansion of the Chest.
3. *Professor Corbett.*—On the Deglutition of alimentary Fluids.
4. *Arthur E. Durham, Esq.*—An experimental Enquiry into the nature of Sleep.
5. *Robert Garner, Esq.*—On the Structures of the Lepadidæ.
6. *Dr. Brown Sequard, F.R.S.*—On the Influence of Cold on the Vital Properties of Animal Tissues.
7. *Prof. Macdonald.*—On the Homology of the Vertebrata and its importance in Zoology.

*The Section will Temporarily adjourn at Half-past Twelve p.m. to Section D.*

### SECTION E.—Geography and Ethnology.

1. *M. Pierre de Tchihatcheff.*—On the Geographical distribution of Plants in Asia Minor.
2. *M. Nicholas Khanikoff.*—On the Geography of the Southern parts of Central Asia.
3. *Captain John Palliser, F.R.G.S.*—On the Course and Results of the British North American Exploring Expedition, under his command in the years 1857-8-9.
4. *Dr. Rae.*—On the Aborigines of the Arctic and Sub-Arctic Regions of North America.
5. *Lieut. Edward Schlagintweit.*—On the Tribes composing the population of Morocco.
6. *Mr. R. Cull, F.S.A.*—On certain Remarkable Deviations in the Structure of Europeans.

### SECTION F.—Economic Science and Statistics.

1. *Henry Fawcett, M.A., Fellow of Trinity Hall, Cambridge.*—On Co-operative Societies, their Social and Political Aspect.
2. *William Newmarch.*—On some suggested Schemes of Taxation, and the difficulties of them.
3. *Edwin Chadwick, C.B.*—On the Economical results of Military Drill in popular Schools.
4. *Dr. Michelsen.*—Serf-dom in Russia.
5. *Richard Dowden.*—On Local Legislation for Local purposes.
6. *Edward Vivian, B.A.*—Vital Statistics, with Report of the Temperance Insurance Office.

### SECTION G.—Mechanical Science.

1. *J. Elder's* paper on a cylindrical spiral boiler will be discussed.
2. *E. A. Cowper.*—On a new mode of obtaining a blast of very high temperature in the manufacture of iron.
3. *William Fairbairn.*—On the density of saturated steam, and on the law of expansion for superheated steam.
4. *William Froude.*—On Giffard's steam-jet feed apparatus.
5. *Professor Hennessy, F.R.S.*—Suggestions relative to inland navigation.
6. *Capt. Blakely, R.A.*—On Artillery.
7. *B. W. Richardson, M.A., M.D.*—Suggestions for an electro-magnetic railway break.

# OFFICERS AND COMMITTEES

## OF THE SEVERAL SECTIONS.

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## SECTION D.—Zoology and Botany. (*Museum*)

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## SECTION E.—Geography and Ethnology. (*Divinity School*)

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### SECTION F.—Economic Science and Statistics. (Schools.)

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OXFORD, 1860.

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# BRITISH ASSOCIATION

FOR THE

## ADVANCEMENT OF SCIENCE.

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THIRTIETH MEETING, 1860.

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### JOURNAL OF SECTIONAL PROCEEDINGS.

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N<sup>o</sup> 5.

Issued MONDAY Morning, July 2,

AT EIGHT A.M.

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**Members who desire to read Memoirs to any Section of the Meeting are requested to forward or deliver the same immediately to the Secretaries of that Section, and to arrange without delay with those Officers, by letter, as to the time and manner of reading the communications.**

**Letters, Parcels, and other Communications for the General and Sectional Officers and other Members of the Association may be left in the care of the Clerk at the Post Office, in the Inquiry Room, Radcliffe Library.**

**The Secretaries of Sections and other Members should not neglect to apply for Letters.**

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#### MEETINGS THIS DAY.

Committees of Sections, at 10 A.M.  
Sections, ..... at 11 A.M.  
Degree of D. C. L. conferred, Theatre, at 2 P.M.  
General Committee, Convocation House, at 3 P.M.  
Capt. Sherrard Osborn's Discourse, Theatre, at 4 P.M.  
Soirée, with Experiments, at 8½ P.M.

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**Any Members of the Association who are willing to exhibit Microscopes or other Instruments on Tuesday Evening, and have not yet signified their wish to do so, are requested to communicate with Dr. Acland without delay.**

Printed, under the Superintendence of the ASSISTANT-GENERAL SECRETARY,  
by JAMES WRIGHT, Printer to the University.

## PAPERS READ

On SATURDAY, June 30.

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### SECTION A.—Mathematical and Physical Science.

1. *Professor W. Thomson.*—Report of Committee appointed to prepare a self-recording atmospheric electrometer for Kew, and portable apparatus for obtaining atmospheric electricity.
  2. *E. Vivian, M.A.*—Results of self-registering Hygrometers.
  3. *Dr. Booth.*—On the relations between hyperconics and elliptic integrals.
  4. *Mr. J. A. Brown.*—On a new induction dip circle.
  5. *Mr. W. R. Birt.*—On the forms of certain lunar craters indicative of a peculiar degrading force, with diagrams.
  6. *Mr. W. R. Birt.*—On atmospheric waves, with diagrams.
  7. *Sir D. Brewster.*—On microscopic vision and a new form of microscope.
  8. *Canon Moseley.*—On the motion of glaciers.
  9. *Professor Maxwell.*—On an instrument for exhibiting any mixture of the colours of the spectrum.
  10. *Mr. A. Cayley.*—On curves of the fourth order having three double points.
  11. *J. S. Glennie.*—On physics as a branch of the science of motion.
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### SECTION B.—Chemical Science.

1. *Dr. Gladstone.*—Chemical notes on (1) Creasote; (2) a compound of Molybdenum, Chlorine, and Fluorine; (3) the diffusion of salts in solution as bearing evidence of their reciprocal decomposition.
  2. *Dr. Lyon Playfair.*—On the representation of neutral Salts on the type of a neutral peroxide  $\text{HO}_2$  instead of a basic oxide  $\text{H}_2\text{O}_2$ .
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### SECTION C.—Geology.

1. *Sir R. I. Murchison.*—To exhibit the New Geological Map of Oxford.
2. *Dr. Geinitz.*—On Snow Crystals observed at Dresden.
3. ————.—On the Silurian Formation in the district of Wilsdruff.
4. *Prof. Harkness.*—On the Metamorphic Rocks of the North of Ireland.
5. *Capt. Woodall.*—On the Intermittent Springs of the Chalk and Oolite of the neighbourhood of Scarborough.
6. *Dr. Anderson.*—Report on the Dura Den excavations.
7. *M. A. Favre.*—On Circular Chains in the Alps.
8. *C. Moore.*—On the contents of three square yards of Triassic Drift.
9. *Rev. G. N. Smith.*—On the Osseous Caves of Tenby.

## SECTION D.—Zoology and Botany, including Physiology.

1. *Dr. Kinahan, F.L.S.*—Report on dredging in Dublin Bay.
  2. *J. O. Westwood, M.A.*—On an Insect heretofore referred to three different orders.
  3. *R. Mac Andrew, F.R.S.*—Report of the General Dredging Committee.
  4. *Dr. C. Collingwood.*—On recurrent animal Form and its influence on systematic Zoology.
  5. *Professor Draper, M.D., New York.*—On the intellectual development of Europe, considered with reference to the views of Mr. Darwin and others, that the progression of Organisms is determined by law.
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## SUB-SECTION D.—Physiology.

1. *Dr. Gibb.*—On Saccharine formation in the Breast.
2. *Archibald Maclaren, Esq.*—On the influence of Systematized Exercise on the Expansion of the Chest.
3. *Robert Garner, Esq.*—On the Structures of the Lepadidæ.

The paper on the Distribution of the Nerves by Prof. Beale was not read on Friday.

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## SECTION E.—Geography and Ethnology.

1. *M. Pierre de Tehihatchef.*—On the Geographical distribution of Plants in Asia Minor.
  2. *Dr. Rae.*—On the Aborigines of the Arctic and Sub-Arctic Regions of North America.
  3. *Captain John Palliser, F.R.G.S.*—On the Course and Results of the British North American Exploring Expedition, under his command in the years 1857–8–9.
  4. *Lieut. Edward Schlagintweit.*—On the Tribes composing the population of Morocco.
  5. *Mr. R. Cull, F.S.A.*—On certain Remarkable Deviations in the Stature of Europeans.
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## SECTION F.—Economic Science and Statistics.

1. *Henry Fawcett, M.A., Fellow of Trinity Hall, Cambridge.*—On Co-operative Societies, their Social and Political Aspect.
  2. *William Newmarch.*—On some suggested Schemes of Taxation, and the difficulties of them.
  3. *Edwin Chadwick, C.B.*—On the Economical results of Military Drill in popular Schools.
  4. *Dr. Michelsen.*—Serfdom in Russia.
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## SECTION G.—Mechanical Science.

1. *J. Elder's* paper on a cylindrical spiral boiler was discussed.
2. *E. A. Cowper.*—On a new mode of obtaining a blast of very high temperature in the manufacture of iron.
3. *William Fairbairn.*—On the density of saturated steam, and on the law of expansion for superheated steam.
4. *William Froude.*—On Giffard's steam-jet feed apparatus.
5. *Professor Hennessy, F.R.S.*—Suggestions relative to inland navigation.



## PAPERS TO BE READ

On MONDAY, July 2.

### SECTION A.—Mathematical and Physical Science.

1. *Prof. Walker.*—Report of the Committee on Balloon Ascents for Scientific purposes.
2. *Dr. Booth.*—On a new Geometrical method for establishing the theory of Conic Sections.
3. *Dr. Booth.*—On an improved Instrument for describing Spirals; invented by Henry Johnson.
4. *Sir D. Brewster.*—On the influence of Small Apertures on Telescopic vision.
5. *Dr. Lee.*—Prospectus of the Hartwell Variable Star Atlas, with six Specimen Proofs.
6. *Dr. Hincks.*—On some recorded Observations of the Planet Venus in the Seventh Century, B. C.
7. *Prof. Hennessy.*—On the Principles of Meteorology.
8. *Prof. Hennessy.*—On the possibility of studying the Earth's Internal Structure from phenomena observed at its surface.
9. *Prof. Peirce.*—On the Physical Constitution of Comets.
10. *Prof. Peirce.*—On the Dynamic condition of Saturn's Rings.
11. *Professor Sylvester.*—A generalization of Poncelet's Theorem for the Linear Representation of Quadratic Radicals.
12. *M. Robert de Schlagintweit.*—On hypsometers, and their comparison with barometers, at great heights.
13. *M. Verdet.*—On the dispersion of planes of polarization produced by magnetism.
14. *Professor Jellett.*—On a new Analysing Prism.
15. *J. Park Harrison.*—On the similarity of the Lunar Curves of Minimum Temperature in 1859 at Utrecht and Greenwich.
16. *B. Stewart.*—On some recent extensions of the Theory of Exchanges.
17. *W. Ladd.*—Improved form of Air Pump for Philosophical Experiments.
18. *Mungo Ponten.*—Further researches regarding the laws of Chromatic dispersion.

### SECTION B.—Chemical Science.

1. *Mr. Buckton.*—On some reactions of zinc-ethyl.
2. *Dr. Von Bose.*—Remarks on the volume theory.
3. *Dr. Andrews.*—On ozone.
4. *Prof. Brodie.*—On the quantitative estimation of the peroxide of hydrogen.
5. *A. Vernon Harcourt.*—On the oxidation of potassium and sodium.
6. *J. J. Coleman.*—Note on the destruction of the bitter principle of chyraitta by the agency of caustic alkali.

### SECTION C.—Geology.

1. *Professor Jukes.*—On the Igneous Rocks interstratified with the Carboniferous Limestone of the Basin of Limerick.
2. *Rev. P. B. Brodie.*—On the Stratigraphical position of certain species of Corals in the Lias.
3. *Rev. W. Lister.*—On some Reptilian foot-prints from the New Red Sandstone North of Wolverhampton.
4. *Rev. Prof. Sedgwick.*—On the geology of the neighbourhood of Cambridge and the fossils of the Upper Green sand.
5. *Rev. W. V. Harcourt.*—On the effects of long continued heat—shewn in the iron furnaces of the west of Yorkshire.

6. *Prof. Rogers*.—On some phenomena of metamorphism in coal in the United States.
  7. *Prof. Ferdinand Von Hochstetter*.—Some observations upon the geological features of the volcanic island of *St. Paul* in the South Indian ocean illustrated by a model in relief of the island made by Capt. Cybulz of the Austrian Artillery.
  8. *Prof. Ferdinand Von Hochstetter*.—Remarks on the geology of New Zealand illustrated by geological maps, drawings, and photographs.
  9. *Rev. J. C. Clutterbuck*.—On the course of the Thames from Lechlade to Windsor as ruled by the geological formations over which it passes.
  10. *Alphonse Gages*.—On some transformations of iron pyrites in connection with fossil remains.
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#### SECTION D.—Zoology and Botany.

1. *Dr. Ogilvie*.—On the woody fibres of flowering and of cryptogamic plants.
  2. *J. Price*.—On *Cydippe*.
  3. *Dr. Daubeny*.—Remarks on equivocal generation.
  4. *Frank T. Buckland*.—On the acclimatisation of animals, birds, &c. in the United Kingdom.
  5. *Dr. Verloren*.—On the effect of temperature and time on the development of certain *Lepidoptera*.
  6. *H. T. Stainton*.—On some peculiar forms amongst the larvæ of the *Micro-Lepidoptera*.
  7. *Lovell Reeve*.—On the *Aspergilla*, or watering-pot moluscs.
  8. *Dr. C. Dresser*.—On the morphological laws in plants.
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#### SUB-SECTION D.—Physiology.

1. *Prof. Corbett, M.D.*—On the Deglutition of Alimentary Fluids.
  2. *Arthur E. Durham, Esq.*—An experimental inquiry into the Nature of Sleep.
  3. *Prof. Van der Hoeven*.—Some remarks on the Anatomy of Potto of Borneo *Perodicticus Bennetti*.
  4. *Dr. B. W. Richardson*.—On the influence of Oxygen in Animal bodies.
  5. *Prof. J. R. Greene*.—A word on Embryology with reference to the constitution of the sub-kingdoms of animals.
  6. *Prof. Carus*.—On the value of development in Systematic Zoology and Animal Morphology.
  7. *Dr. C. B. Radcliffe*.—On muscular action from an electrical point of view.
  8. *Prof. Beale, F.R.S.*—On the ultimate arrangements of nerves in muscular tissue.
  9. *Dr. R. McDonnell*.—On sugar and amyloid substance in the animal economy.
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#### SECTION E.—Geography and Ethnology.

1. *John Crawford, Pres. Eth. Soc.*—On the Aryan or Indo-Germanic theory of races.
2. *Col. Shaffner, N.S.*—On the Geography of the proposed Communication between England and America *via* the Farøes, Iceland, and Greenland.
3. *Rev. Dr. Booth*.—On a Deep Sea Pressure Gauge; invented by Henry Johnson.
4. *Capt. M. H. Syngé, R.E.*—On the proposed Communication between Atlantic and Pacific *via* British North America.
5. *Professor Ferdinand von Hochstetter (Vienna) Geologist of the Austrian Novara Expedition*.—A new Map of the Interior of the Northern Island of New Zealand, constructed during an Inland Journey in 1859.
6. *Rev. Dr. Hincks*.—On some Ethnological Boulders, and their probable origin.
7. *Mr. R. Cull*.—On the existence of a True Plural of a Personal Pronoun in a living European Language.

## SECTION F.—Economic Science and Statistics.

1. *J. J. Fox*.—On the Province of the Statistician.
2. *Richard Dowden*.—Local Taxation for Local Purposes.
3. *Miss Carpenter*.—Statistics of Schools for neglected Children.
4. *John Hitchman*.—On Sanitary Drainage of Towns.
5. *J. M. Mitchell*.—On the Statistics of the Herring Fishery on the British Coasts.
6. *Ker Porter*.—Some hints for the Building of Cottages for Agricultural Labourers.
7. *E. Jarvis, (Boston, U. S.)*.—On the System of Taxation prevailing in the United States.

## SECTION G.—Mechanical Science.

1. *Capt. Blakeley*.—On Rifled Cannon.
2. *William Fairbairn*.—Experiments to determine the effect of vibratory action and long continued changes of Load upon wrought iron Girders.
3. *David Chadwick*.—On Water Meters.
4. *John Fisher*.—On an Atmospheric Washing Machine.
5. *B. W. Richardson, M.A., M.D.*.—Suggestions for an electro-magnetic railway break.
6. *Admiral Tayler*.—A novel means to lessen the frightful loss of life round our exposed coasts by rendering the element itself an inert barrier against the power of the sea; also a permanent deep water harbour of refuge by artificial bars.

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OXFORD, 1860.

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# BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.

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THIRTIETH MEETING, 1860.

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JOURNAL OF SECTIONAL PROCEEDINGS.

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N<sup>o</sup> 6.

Issued TUESDAY Morning, July 3,

AT EIGHT A.M.

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**Members** who desire to read **Memoirs** to any Section of the Meeting are requested to forward or deliver the same immediately to the Secretaries of that Section, and to arrange without delay with those Officers, by letter, as to the time and manner of reading the communications.

**Letters, Parcels, and other Communications** for the General and Sectional Officers and other Members of the Association may be left in the care of the *Clerk at the Post Office, in the Inquiry Room, Radcliffe Library.*

**The Secretaries of Sections and other Members** should not neglect to apply for Letters.

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## MEETINGS THIS DAY.

Committees of Sections, at 10 A.M.

Sections, ..... at 11 A.M.

Committee of Recommendations, Clarendon, at 3 P.M.

Soirée, with Microscopes, at 8½ P.M.

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**NOTICE.**—*Copies of Supplement to Daubeny's 'Volcanos' may be had gratis by Gentlemen who possess the Work—on application in the Inquiry Room.*

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# PAPERS READ

## On MONDAY, July 2.

### SECTION A.—Mathematical and Physical Science.

1. *Prof. Walker.*—Report of the Committee on Balloon Ascents for Scientific purposes.
2. *Dr. Booth.*—On a new Geometrical method for establishing the theory of Conic Sections.
3. *Dr. Booth.*—On an improved Instrument for describing Spirals; invented by Henry Johnson.
4. *Sir D. Brewster.*—On the influence of Small Apertures on Telescopic vision.
5. *Dr. Lee.*—Prospectus of the Hartwell Variable Star Atlas, with six Specimen Proofs.
6. *Dr. Hincks.*—On some recorded Observations of the Planet Venus in the Seventh Century, B. C.
7. *Prof. Hennessy.*—On the Principles of Meteorology.
8. *Prof. Hennessy.*—On the possibility of studying the Earth's Internal Structure from phenomena observed at its surface.
9. *Prof. Peirce.*—On the Physical Constitution of Comets.
10. *Prof. Peirce.*—On the Dynamic condition of Saturn's Rings.
11. *Professor Sylvester.*—A generalization of Poncelet's Theorem for the Linear Representation of Quadratic Radicals.
12. *M. Robert de Schlagintweit.*—On hypsometers, and their comparison with barometers, at great heights.
13. *Professor Jellett.*—On a new Analysing Prism.
14. *B. Stewart.*—On some recent extensions of the Theory of Exchanges.
15. *Mungo Ponten.*—Further researches regarding the laws of Chromatic dispersion.

### SECTION B.—Chemical Science.

1. *Mr. Buckton.*—On some reactions of zinc-ethyl.
2. *Dr. Von Bose.*—Remarks on the volume theory.
3. *Dr. Andrews.*—On ozone.
4. *Prof. Brodie.*—On the quantitative estimation of the peroxide of hydrogen.
5. *A. Vernon Harcourt.*—On the oxidation of potassium and sodium.

### SECTION C.—Geology.

1. *Professor Jukes.*—On the Igneous Rocks interstratified with the Carboniferous Limestone of the Basin of Limerick.
2. *Rev. P. B. Brodie.*—On the Stratigraphical position of certain species of Corals in the Lias.
3. *Rev. W. Lister.*—On some Reptilian foot-prints from the New Red Sandstone North of Wolverhampton.
4. *Rev. Prof. Sedgwick.*—On the geology of the neighbourhood of Cambridge and the fossils of the Upper Green sand.
5. *Rev. W. V. Harcourt.*—On the effects of long continued heat—shewn in the iron furnaces of the west of Yorkshire.
6. *Prof. Rogers.*—On some phenomena of metamorphism in coal in the United States.

### SECTION D.—Zoology and Botany.

1. *Dr. Ogilvie.*—On the woody fibres of flowering and of cryptogamic plants.
2. *J. Price.*—On *Cydippe*.
3. *Dr. Daubeny.*—Remarks on equivocal generation.
4. *Frank T. Buckland.*—On the acclimatisation of animals, birds, &c. in the United Kingdom.
5. *Dr. Verloren.*—On the effect of temperature and time on the development of certain *Lepidoptera*.
6. *H. T. Stainton.*—On some peculiar forms amongst the larvæ of the *Micro-Lepidoptera*.
7. *Lovell Reeve.*—On the *Aspergilla*, or watering-pot moluscs.
8. *Dr. C. Dresser.*—On the morphological laws in plants.

### SUB-SECTION D.—Physiology.

1. *Prof. Corbett, M.D.*—On the Deglutition of Alimentary Fluids.
2. *Arthur E. Durham, Esq.*—An experimental inquiry into the Nature of Sleep.
3. *Prof. Van der Hoeven.*—Some remarks on the Anatomy of Potto of Borneo *Perodicticus Bennettii*.
4. *Dr. R. McDonnell.*—On sugar and amyloid substance in the animal economy.
5. *Prof. J. R. Greene.*—A word on Embryology with reference to the constitution of the sub-kingdoms of animals.
6. *Prof. Carus.*—On the value of development in Systematic Zoology and Animal Morphology.

### SECTION E.—Geography and Ethnology.

1. *John Crawford, Pres. Eth. Soc.*—On the Aryan or Indo-Germanic theory of races.
2. *Col. Shaffner, N.S.*—On the Geography of the proposed Communication between England and America *via* the Faröes, Iceland, and Greenland.
3. *Rev. Dr. Booth.*—On a Deep Sea Pressure Gauge; invented by Henry Johnson.
4. *Capt. M. H. Synge, R.E.*—On the proposed Communication between Atlantic and Pacific *via* British North America.
5. *Professor Ferdinand von Hochstetter (Vienna) Geologist of the Austrian Novara Expedition.*—A new Map of the Interior of the Northern Island of New Zealand, constructed during an Inland Journey in 1859.
6. *Rev. Dr. Hincks.*—On some Ethnological Boulders, and their probable origin.
7. *Mr. R. Cull.*—On the existence of a True Plural of a Personal Pronoun in a living European Language.

### SECTION F.—Economic Science and Statistics.

1. *J. J. Fox.*—On the Province of the Statistician.
2. *Richard Dowden.*—Local Taxation for Local Purposes.
3. *Miss Carpenter.*—Statistics of Schools for neglected Children.
4. *John Hitchman.*—On Sanitary Drainage of Towns.

### SECTION G.—Mechanical Science.

1. *Capt. Blakeley.*—On Rifled Cannon.
2. *David Chadwick.*—On Water Meters.
3. *B. W. Richardson, M.A., M.D.*—Suggestions for an electro-magnetic railway break.

## PAPERS TO BE READ

On TUESDAY, July 3.

### SECTION A.—Mathematical and Physical Science.

*This Section will hold a Sitting on Wednesday Morning from 10 a.m. to 1 p.m.*

1. *Werner and C. W. Siemens.*—Outline of the principles and practice involved in dealing with the electrical conditions of submarine electric telegraphs.
2. *Rev. S. Earnshaw.*—On the triplicity of Sound.
3. *R. Thomas.*—On thin films of decomposed glass found near Oxford.
4. *Sir D. Brewster.*—Notice respecting certain phenomena of crystallization and polarization in decomposed glass.
5. *Professor Peirce.*—On the motion of a pendulum in a vertical plane when the point of suspension moves uniformly on a circumference in the same plane.
6. *Henry Draper, M.D.*—On a reflecting telescope for celestial photography, now erecting at Hastings, near New York; communicated by *Prof. Draper*.
7. *Henry J. S. Smith.*—On the solution of linear indeterminate equations in whole numbers.
8. *Professor Maxwell.*—On the results of Bernoulli's theory of gases as applied to their internal friction, their diffusion, and their conductivity for heat.



9. *Professor W. B. Rogers, Boston.*—Experiments and conclusions on binocular vision, and some experiments on some of the phenomena of electrical vacuum tubes.
10. *Professor Lindelöf.*—On Caustic Surfaces.
11. *Dr. Brennecke.*—On some solutions of the problem of tactions by Apollonius of Perga by means of modern geometry.
12. *Rev. T. P. Kirkman.*—On the roots of substitutions.
13. *Sir W. Snow Harris.*—On the exhibition of Electrical force.

### SUB-SECTION A.

(Natural Philosophy School.)

1. *Capt. Maury.*—On the climate of the Antarctic Regions as indicated by observations upon the height of the Barometer and direction of the Winds at Sea. And a Letter on Antarctic Expeditions.
2. *M. Verdet.*—On the Dispersion of Planes of Polarization produced by Magnetism.
3. *J. A. Broun.*—On the Diurnal variations of the Magnetic declination at the Magnetic Equator, and the Decennial period.
4. *J. A. Broun.*—On certain results of Observations in the Observatory of H. H. the Rajah of Travancore.
5. *J. Park Harrison.*—On the similarity of the Lunar Curves of Minimum Temperature in 1859 at Utrecht and Greenwich.
6. *Captain Childers.*—On the Meteorology and Climate of Jersey.
7. *Rev. A. Weld.*—Results of ten years' Meteorological Observations at Stonyhurst.
8. *G. T. Symons.*—Results of an Investigation into English Thunderstorms during 1857-8-9.
9. *G. T. Symons.*—On the Thunderstorms of 1859.
10. *M. Serrin.*—1° Régulateur automatique de lumière électrique. 2° Pile a Sulfate de Plomb de M. Edmond Becquerel. 3° Phosphorescence de M. Edmund Becquerel.
11. *Mr. Hodgson.*—Description of the Brilliant Eruption on the Sun, 1st September, 1859.
12. *Capt. Parker Snow.*—On Practical Experience of the Law of Storms in each quarter of the Globe.
13. *Prof. W. Thomson.*—Notes on Atmospheric Electricity.

### SECTION B.—Chemical Science.

1. *J. J. Coleman.*—Note on the destruction of the bitter principle of chyratta by the agency of caustic alkali.
2. *J. B. Laves, F.R.S., and Dr. J. H. Gilbert.*—On the composition of the ash of wheat grown under various circumstances.
3. *Dr. Thudichum.*—On Thiotherine, a sulphuretted product of decomposition of albuminous substances.
4. *Dr. W. Wallace.*—On the causes of fire in Turkey-red stoves.

### SECTION C.—Geology.

1. *Prof. Sedgwick.*—On the geology of the vicinity of the neighbourhood of Cambridge, and the fossils of the Upper Green-sand.
2. *Prof. Ferdinand Von Hochstetter.*—Some observations upon the geological features of the volcanic island of *St. Paul* in the South Indian ocean illustrated by a model in relief of the island made by Capt. Cybulz of the Austrian Artillery.
3. *Prof. Ferdinand Von Hochstetter.*—Remarks on the geology of New Zealand illustrated by geological maps, drawings, and photographs.
4. *Rev. J. C. Clutterbuck.*—On the course of the Thames from Lechlade to Windsor as ruled by the geological formations over which it passes.
5. *Alphonse Gages.*—On some transformations of iron pyrites in connection with fossil remains.
6. *William Molyneux.*—Remarks on fossil fish from the North Staffordshire coal fields.

7. *W. Powrie* (communicated by *Sir R. I. Murchison*).—On the old red sandstone and its fossil fish in Forfarshire, with an account of the fish by *Sir P. Egerton*.
8. *Sir P. Egerton*.—On a new form of ichthyolite discovered by *Mr. Peach*.
9. *Baron Francisco Anca*.—On two newly discovered caves in Sicily containing worked flints.
10. *E. Hull*.—To explain the six-inch maps of the geological survey.
11. *Rev. W. Symonds*.—On the selection of a peculiar geological habitat by some of the rarer British plants.
12. *Rev. Dr. Whewell and Prof. Tennant*.—On the Kohinoor previous to its cutting.
13. *Dr. W. S. Lindsay*.—On a recent volcanic eruption in Ireland.
14. *Sir D. Brewster*.—Details respecting a nail found in Kurgoodie quarry.
15. *J. A. Knipe*.—On the Tynedale coal field and whinsill.
16. *Rev. J. Dingle*.—On the corrugation of strata in the vicinity of mountain chains.
17. *J. Price*.—On slikensides.

#### SECTION D.—Zoology and Botany, including Physiology.

1. *Dr. Collingwood, F.L.S.*—Notes on the *Nudibranchiata* of the Mersey and Dee.
2. *Dr. Collingwood, F.L.S.*—Remarks on the respiration, &c. of the *Nudibranchiate mollusca*.
3. *P. Lutley Slater, F.L.S.*—On the geographical distribution of vertebrates.
4. *Maxwell J. Masters*.—On abnormal variations in plants.
5. *Rev. A. R. Hogan, A.M.*—A notice of the British well-shrimps.
6. *Rev. The President*.—On the supposed germination of mummy wheat.
7. *J. O. Westwood, A.M.*—Notes on mummy beetles.
8. *C. Peach*.—On the statistics of the herring fishery.
9. *J. M. Mitchell*.—On the economical history and statistics of the herring fishery with the view of protecting and promoting this great national fishery.
10. *Dr. C. Percival Wright, F.L.S.*—Notes on *Tomopteris onisciformis*.

#### SUB-SECTION D.—Physiology.

1. *M. Ollier*.—To exhibit Specimens illustrating the Artificial production of Bone and Osseous Grafts.
2. *Dr. C. B. Radcliffe*.—Experiments on Muscular Action from an Electrical point of view.
3. *Prof. Beale, F.R.S.*—On the Ultimate Arrangement of Nerves in Muscular Tissue.
4. *Dr. B. W. Richardson*.—On the influence of Oxygen in Animal bodies.
5. *Dr. Thudicum*.—On the Physiological relations of the Colouring Matter of the Bile.
6. *Dr. Brown Sequard, F.R.S.*—On the Influence of Cold on the Vital Properties of Animal Tissues.

#### SECTION E.—Geography and Ethnology.

1. *Capt. Sir Edward Belcher, R.N., C.B.*—On the manufacture of Stone Hatchets and other Implements by the Esquimaux, illustrated by native Tools, Arrow-heads, &c., &c.
2. *Dr. James Hunt*.—On the Antiquity of the Human Race.
3. *T. W. Atkinson*.—On the Caravan routes from the Russian Frontier to Khiva, Bokhara, Kokhan, and Yarkand, with suggestions for opening up a Trade between Central Asia and India.
4. *Capt. Cifulz (Imperial Austrian Artillery)*.—To exhibit Relief Models of the Alps, &c., &c.
5. *Dr. Robert Knox*.—On the Origin of the Arts, and the influence of Race in their development.
6. *J. Mickie*.—Cruise in the Gulf of Pe-che-li and Leo-tung (China).
7. *M. Robert von Schlagintweit*.—Remarks on some of the Races of India and High Asia (in connection with casts exhibited).
8. *D. May, R.N.*—Journey in the Yoruba and Nupè countries.

9. *Rev. Prof. Graves.*—On the arrangement of the Forts and dwelling places of the ancient Irish.
10. *T. W. Atkinson.*—On the caravan route from Yarkand to Mai-ma-tchin, with a short account of this town, through which the trade is carried on between Russia and China.
11. *Daniel A. Lange.*—Brief account of the progress of the works of the Isthmus of Suez Canal.

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#### SECTION F.—Economic Science and Statistics.

1. *Frederick Purdy.*—On non-official Parliamentary Statistics.
2. *E. Jarvis (Boston, U. S.).*—On the System of Taxation prevailing in the United States.
3. *H. J. Ker Porter, M.R.I.A.*—Some hints for the Building of Cottages for Agricultural Labourers.
4. *J. M. Mitchell.*—On the Statistics of the Herring Fishery on the British coasts.

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#### SECTION G.—Mechanical Science.

1. *William Fairbairn.*—Experiments to determine the effect of vibratory action and long continued changes of Load upon wrought iron Girders.
2. *Admiral Tayler.*—A novel means to lessen the frightful loss of life round our exposed coasts by rendering the element itself an inert barrier against the power of the sea; also a permanent deep water harbour of refuge by artificial bars.
3. *Geo. F. Train.*—On Street Railways as used in the United States, (with a Model.)
4. *S. W. Silver.*—On the character and comparative value of Gutta Percha and India Rubber employed as Insulators for Subaqueous Telegraphic wires.
5. *John Fisher.*—On an Atmospheric Washing Machine.

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OXFORD, 1860.

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BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.

*Exhibitors of Microscopes, and Microscopic objects, &c.,  
on the Evening of Tuesday, July 3.*

## GROUND FLOOR.

*Central Aisle of the Court.*

Names.	Residence.	Objects exhibited.
Mr. Adie	London	Instruments.
Mr. Baker	London	Microscopes.
Dr. Barker, F.R.C.S.	Bedford	Anatomical objects.
Mr. Baxter	Oxford	Chiefly Botanical Sections.
Professor Beale, F.R.S.	London	{ Muscle, Nerves, Secreting Structure.
Mr. Bowerbank, F.R.S.	London	{ Comparative Anatomy of Nervous System.
Mr. Bryson	Edinburgh	Micro-photographs.
Mr. Casella	London	{ Meteorological and other Instruments.
Mrs. Clarke	Wd. Eaton	Entomological.
Mr. E. W. Cooke, A.R.A.	London	Botanical and other objects.
Mr. Dallmeyer	London	{ Microscopes, and an Equatorial.
Dr. Daubeny, F.R.S.	Oxford	Chiefly Botanical Sections.
M. M. Hartnach	Paris	Microscope.
Dr. Henry, F.R.S.	Hereford	Amici's lenses.
Mr. Jabez Hogg, F.L.S.	London	Minute Anatomy of the Eye.
Mr. Ince	London	
Mr. Ladd	London	{ Electrical and other Instruments.
Mr. Millar	London	Conchilus Volvox.
Mr. Mogenie	London	Micro-photographs.

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Mr. Pillischer	London	Microscopes.
Mr. Pitchford	London	Various.
Professor Quekett, F.R.S..... }	London	Physiological.
Dr. Acland, F.R.S. }	Oxford	Physiological.
Professor Rolleston, M.D., F.L.S..... }		
Mr. Robertson		
Mr. Ross	London	Microscopes.
Mr. Salmon	London	Microscopes.
Mr. Smith	London	Test objects.
Messrs Smith and Beck	London	Microscopes and Injections.
Mr. Symonds, F.R.C.S.	Oxford	Various.
Mr. Thomas	Oxford	Polarizing Apparatus, &c.
Mr. Tomkins, M.R.C.S.	London	Protozoa and Protophyta.
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Mr. Varley	London	Circulation in Plants.
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Mr. Westwood, M.A., F.L.S. }	Oxford	Annulosa.
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